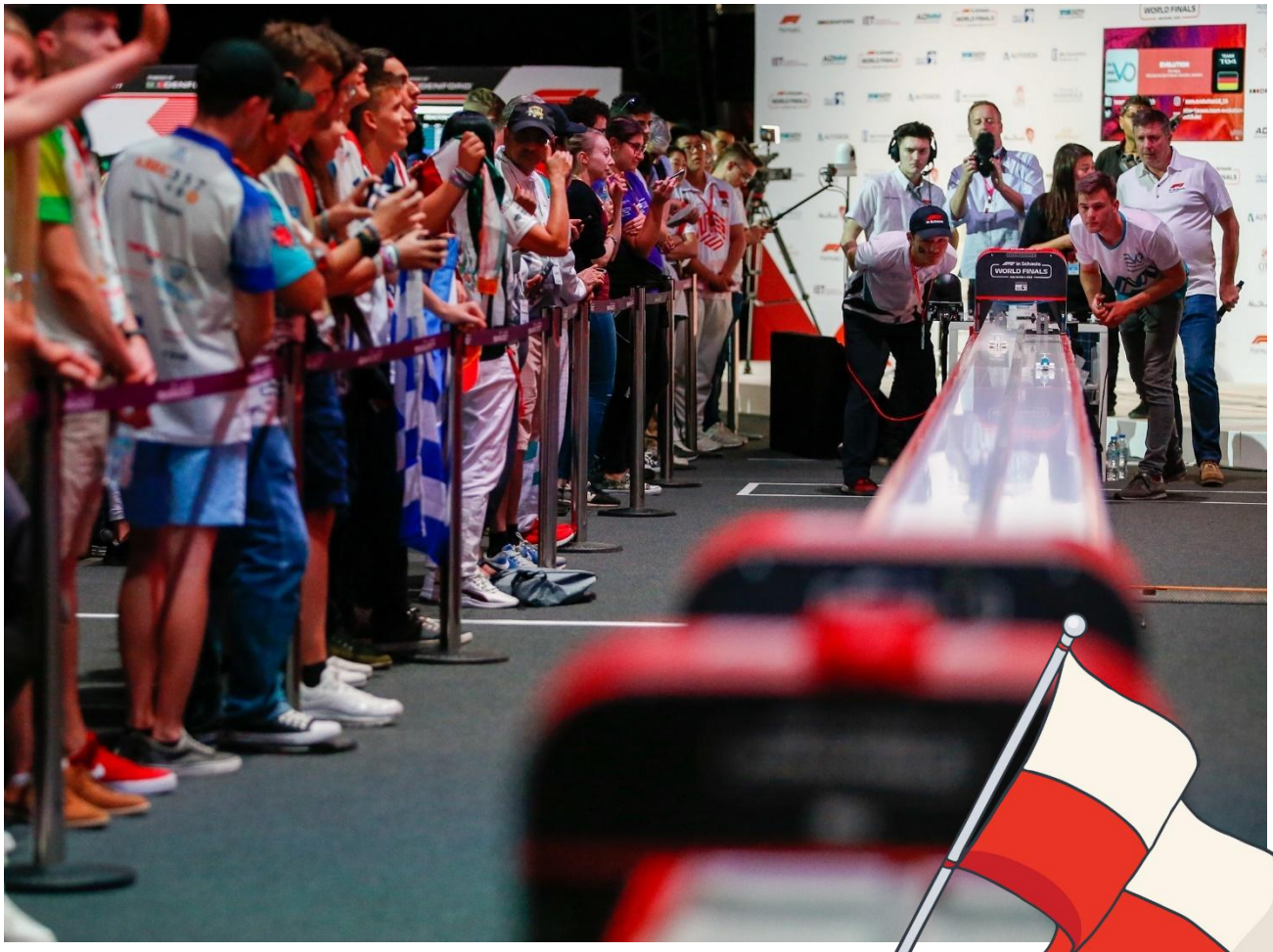
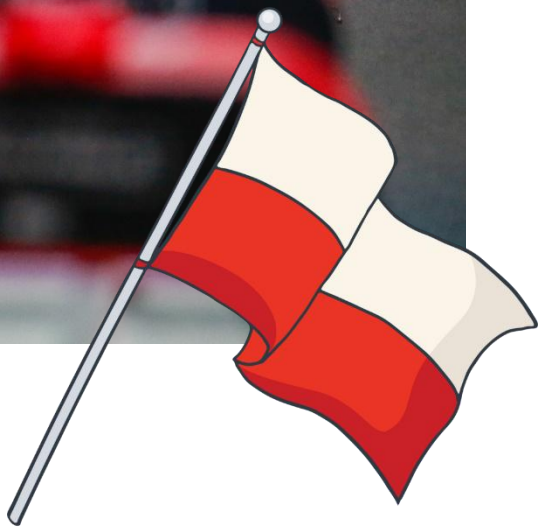
STEM RACING™ POLAND

Development Class
Competition Regulations 2025-2026





What to do:

Your first steps...

Your STEM Racing™ journey – Where to start:

1. DOWNLOAD AND READ THE RULES

- Download and carefully read through this season's Technical Regulations, alongside this document.
- Download the supplementary Project Management Guidebook, which is also available on www.stemracing.com. This guide will help your teams pick up and use industry level techniques and terminology to use in their project.

2. Register your team(s)

- Register your teams through the STEM Racing Poland website stemracing.pl. **Schools can enter up to FIVE teams**. Get creative and think of ways to raise your 360 PLN registration fee - aim not to pay it yourself!

3. Design the F1® car of the future

- Start with a fresh piece of paper and a head full of ideas, start designing the basic aerodynamic shape of the body and wings of your car. ***Remember no idea is too crazy at this stage…***

4. Download our stock CAD files

- Download the official CAD files from the **STEM Racing downloads page**. We strongly recommend the **FREE Autodesk Fusion 360** software package, which is available to download through the **STEM Racing website**. There are plenty of helpful tutorials available to help you get started.

5. Create your two Portfolios

- You must create one Design and Engineering Portfolio and one Enterprise Portfolio.
- See the **Judging: Criteria and the Scorecards** section for guidance.

6. Qualify for Polish Finals!

- All registered teams that pass the formal requirements will be qualified for the national finals.

7. Prepare your Verbal Presentation

- You must prepare a 10-minute Verbal Presentation.
- See the **Judging: Criteria and the Scorecards** section for guidance.

8. Manufacture your car

- **Make sure your design is fully fulfilling the technical regulations before manufacturing your car**.
- **Teams qualified for National Finals will receive advice and a starter kit to help manufacture their cars.**

TURN UP ON COMPETITION DAY!

- Attend National Finals!

What do you need to produce?

2 x 5 Page Portfolios

A4 Engineering Drawings

A4 Car Renderings

1 x 10 minute Verbal Presentation

2 x Race Car

1 x Pit Display

Registration process

Registration involves submitting your team details online at stemracing.pl, confirming your active participation in the competition. Each team entering the STEM Racing Challenge must pay a registration fee of 360 PLN. After paying the entry fee, each team will receive a starting package necessary to build their racing car, i.e. 2 blocks, a set of wheels and axles. At 60 PLN per team member for a team of 6, this is your first chance to practise raising money ahead of the bigger task of attracting team sponsorship later in the project! Get your thinking caps on and work out how to raise your portion of the team registration fee. This registration fee is non-refundable and must be paid in full before participating in STEM Racing. The registration fee has to be paid within 14 days of the registration date.

The key is to avoid covering these costs yourself! We strongly suggest trying to raise your registration fee through either sponsorship or fundraising. Many businesses are eager to sponsor motivated, ambitious teams. The key is the right pitch. Alternatively, if you're handy with a packet of cake mix, consider organising an F1-themed bake sale to raise the funds!

Finals Qualification

Polish national finals are aiming to be hosted in May/June and will have a limit of 20 teams. If there are more than 20 registered teams, the organizer reserves the right to organize regional finals in which the finalists will be selected.

The Challenge

You are the Formula One Team commissioned to design, make and race the fastest F1® car of the future, driven by compact, compressed air power units.

In order to enter the championship, you must allocate job roles to the members of your group. Ideally, one role should be allocated to each person. However, you may have to double up on your role and responsibilities, depending on the number of people you have available. The following job roles are examples of what could be covered by the members of your team:

Project Manager (maximum 1 person)

This person is responsible for managing the team, project management of all key deliverables and ensuring that all race cars are ready for the competition. The team manager works closely with all members of the team, offering assistance where necessary.

Finance Manager

This person organises budgets and resources needed for designing and making the car(s) and team project work. They might keep track of all expenses and income generated, allocating certain funds to certain areas of the project, for example Car, Pit Display, Portfolio, team uniforms.

Manufacturing Engineer

This person is responsible for advising team members on the manufacture of the car and the constraints of the machining process. Manufacturing engineers will need to liaise with the design engineers to report and help solve any problems with the construction of the car.

Design Engineer

This role is responsible for the styling and aerodynamic performance of the car design. Design engineers will need to liaise with the manufacturing engineers to ensure their ideas can be realised.

Graphic Designer

This person could be responsible for producing the colour schemes applied to the vehicle, including any special sponsorship decals, together with the final graphic renderings and any additional team marketing materials. The graphic designer will need to liaise with the design engineer to ensure any schemes will fit the shape of the vehicle and the resources manager for additional marketing development.

Sponsorship & Marketing Manager

This person could be responsible for generating sponsorship proposals for potential sponsors, contacting firms and marketing the team through different media. They may be tasked with creating and managing the team's social media accounts as well as thinking up ways to generate interest and income for the team through marketing events.

IMPORTANT - Please register your teams online at www.stemracing.pl as soon as you have allocated your job roles.

There are so many tasks that must be mastered, in order to design, manufacture, prepare and finally, enter a car for racing. Teamwork and project management throughout the team will be vital to your success. A real F1 team succeeds because all the people learn to work together and support each other. Remember, no one person is more important than other members in the team.

PLEASE ENSURE YOU READ AND CHECK THE STEM RACING POLAND TECHNICAL REGULATIONS VERY THOROUGHLY BEFORE BEGINNING THE DESIGN AND CONSTRUCTION OF YOUR STEM RACING CAR.

Design Considerations

Design Preparation

Before beginning to design your car, you will need:

- A 3D CAD solid modelling software package at your school/college. We strongly recommend the use of Autodesk Fusion 360, which can be obtained **free of charge** through the STEM Racing website at: **https://www.stemracing.com/partners/autodesk**
- Our 3D CAD file of the official F1® Model Block. This can be downloaded from **https://www.stemracing.com/downloads**
- The dimensions of the F1® Model Block are also available in the appendix of the Technical Regulations
- Hopefully, an endless supply of ideas!

Training

CAD packages will help you draw and develop your ideas in 3D. Of course, as with most drawing packages, it takes time to learn how to use them. Your technology teacher should be able to show you how the software works, but members of your team will need to spend some time exploring the software, so you can see what it can do and how it can help you design your F1 car. A wealth of Autodesk tutorial videos specific to the STEM Racing competition are available via our website.

Research

Investigate existing F1 car designs. Your teacher may be able to help you use the internet to find out the latest developments occurring in the world of F1 design. Concentrate your research on areas that could help your team, for example, aerodynamics and car body designs and then try to apply the principles to your own ideas.

Testing

Your team may want to consider testing a variety of car designs, or car parts, in a wind and/or smoke tunnel to evaluate their aerodynamic performance. 'Autodesk Flow Design' virtual wind tunnel software is available to download free of charge, please visit **https://www.stemracing.com/partners/autodesk**

Manufacturing Considerations

If you signed for competition STEM Racing Poland, you will receive an provide an essential racing kit, Official actual F1® Model Blocks, a set of wheels and set of axles.

Please note that your car design template must be at least 10mm shorter at one end, compared to the actual F1® Model Block. You will not be able to machine to the extreme ends of the official F1® Model Block since they are sometimes used for attaching the CNC machine fixtures. Damage could occur if the cutting tool hits any of these fixtures.

The fixture is used to stop the official F1® Model Block moving whilst being machined. It also allows the block to be accurately repositioned. Please note however, that some machines will process with only one cut, others may require two or more cuts and therefore you will need to take this into account when you are designing your car.

Once machined, you can smooth down the official F1® Model Block design and finish with primer and paint.

Note that only a limited amount of hand finishing to the body is allowed. You could also decorate the car body with any sponsorship stickers, decals, advertising or colour schemes.

Competition:

Explanations and definitions...

ARTICLE C1 – DEFINITIONS

C1.1 Article

Each section in all documentation will be referred to as an Article which brings STEM Racing documents in line with the Fédération Internationale de l'Automobile (FIA) documentation.

C1.2 Parc Ferme

A secure area where all race cars are held to prevent unauthorised handling but to allow technical inspections to be conducted by the Judges. (Literal meaning in French of 'closed park').

C1.3 Competition Schedule

The competition program will detail the schedule of judging activities for all teams.

C1.4 Key performance indicators (KPI's)

These are portions of text that feature on the scorecards within a corresponding points range. The KPI's describe the type of evidence the Judges are looking for in order to score the team appropriately.

C1.5 Car race time value

A 'car race time' value is the actual time taken for a STEM Racing car to travel the track from start to finish, measured from the instant the launch pod fires to when the car breaks the finish line timing beam. In the case of reaction races, the 'car race time' value is calculated as the 'total race time' value displayed on the electronic start gate minus the 'reaction time' value displayed for that race.

C1.6 Total race time value

The 'total race time' value is displayed in the total time field on the electronic start gate at the conclusion of every race. This time is the sum of the 'car race time' value and any 'reaction time' value displayed on the electronic start gate.

C1.7 Reaction time value

A 'reaction time' value is the time recorded from the instant the five (5) start lights extinguish to the instant the start trigger is activated by the driver. This value is displayed in the reaction time field on the start gate.

C1.8 Project elements

These are any materials and resources that the team presents as part of its entry for any judging activity.

C1.9 Engineering Drawings

Hand drawn or CAD produced drawings, which along with relevant machinery and/or CAM programs, could theoretically be used to manufacture the fully assembled car by a third party. Such drawings include all relevant dimensions, tolerances and material information. STEM Racing engineering drawings include detail to specifically identify and prove compliance for the virtual cargo and wing surfaces.

C1.10 Renderings

Renderings are images intended to illustrate the three-dimensional form of an object. These can be hand drawn or CAD generated in isometric projection, oblique projection or perspective.

ARTICLE C2 – GENERAL INFORMATION

C2.1 Competing teams

- **C2.1.1** Each team must consist of a minimum of 3 students to a maximum of 6, between the ages of 11-19. If for any reason, a team member cannot travel to an event and is to be replaced by another individual, this must be brought to the attention of STEM Racing prior to the event.
- **C2.1.2** Only the registered team members of any official competing team (maximum 6) are permitted to wear the team's uniform.
- **C2.1.3** During the competition, only the official core team members (maximum of 6) can represent the team at registration, Pit Display set up, Scrutineering review, Verbal Presentation, Design & Engineering judging and

Enterprise judging, racing, on-stage presentations and any direct communication with the Chair of Judges or Event/Competition Directors.

C2.2 Team responsibilities

- **C2.2.1** Teams must read the STEM Racing **Poland Dev Class Technical Regulations** carefully to ensure their car(s) comply with those regulations.
- **C2.2.2** Teams must read the **Poland Competition Regulations (this document)** carefully to ensure that all project elements satisfy these regulations and that they understand the requirements and procedures for all aspects of the competition and judging.
- **C2.2.3** During the competition it's the team's responsibility to ensure that team members are present at the correct time and location for all scheduled activities.
- **C2.2.4** Security of the pit display and its elements is the team's responsibility during competition.

C2.3 Role and responsibility of supervising teacher / adult.

- **C2.3.1** All supervising teachers / adults should explain all relevant information to their students.
- **C2.3.2** It is the primary responsibility of any supervising teacher/adult to ensure duty of care/well-being for all their student team members. Any concerns arising during the event in relation to this should be brought to the attention of STEM Racing immediately.
- **C2.3.3** The supervising teacher/adult is permitted to be present during any judging activity with their team but, must not interact in any way with the student team, judges or judging process. Any incident considered inappropriate will be brought to the attention of the Chair of Judges and penalty points may be applied.

C2.4 Regulations documents

- **C2.4.1** STEM Racing issues the regulations, their revisions and any amendments made.
- **C2.4.2** The Competition Regulations (this document), is mainly concerned with regulations and procedures directly related to judging and the competition event. Competition Regulation articles have a 'C' prefix.
- **C2.4.3** Technical Regulations – a separate document which is mainly concerned with regulations that are directly related to STEM Racing car design and manufacture.

C2.5 Interpretation of the regulations

- **C2.5.1** The final text of these regulations is in English, should any dispute arise over their interpretation, the regulation text, diagrams and any related definitions should be considered together for the purpose of interpretation.
- **C2.5.2** Text clarification - any frequently asked questions that are deemed by STEM Racing to be related to text needing clarification will be answered. The question and the clarification will be published to all teams at the same time.

C2.6 Supplementary competition regulations

Other documents may be issued by STEM Racing that provide teams with further logistic and important event information. Any supplementary regulations will be issued to all lead teachers and team managers, where the team manager has supplied STEM Racing with a contact email address.

C2.7 Design ideas and regulation compliance queries

Teams are not permitted to seek a ruling from STEM Racing, any competition official or judge before the event as to whether a design idea complies with the regulations. Rulings will only be made by the Judges at an event. Design compliance to the regulation's forms part of the competition. As in Formula 1, innovation is encouraged and STEM Racing teams may also find, sometimes controversial ways, of creating design features by pushing the boundaries in order to get an extra competitive edge.

C2.8 Team partnerships

- **C2.8.1** STEM Racing teams are encouraged to develop mentoring partnerships with businesses, industry or higher education organisations throughout their project.
- **C2.8.2** All design work, text and scripting for all project elements presented for assessment must be wholly undertaken and created by the team. This includes all CAD and CAM data, electronic portfolio and graphic content.

- **C2.8.3** All aspects of any partnerships should also be represented in the team's portfolio. For project elements produced utilising some outside assistance, teams should be able to demonstrate to the judges a high level of understanding of, and justification for, any of the processes used.
- **C2.8.4** 'Common sense' will prevail for project elements or components that a team has purchased from a supplier. E.g. bearings, screw eye, display hardware. Teams should be able to explain and justify why a specific component was selected / purchased over other similar available components.

C2.9 Mandatory project elements for National Finals entry

The following is a summary of the mandatory elements required for judging:

- Two (2) STEM Racing cars including all optional replacement components
- One (1) A3 or similar Design & Engineering Portfolio
- One (1) A3 or similar Enterprise Portfolio
- A 10-minute Verbal Presentation with laptop
- A Pit Display
- Electronic version of both portfolios submitted to STEM Racing
- A4 Engineering Drawings of your completed race car
- A4 Renderings of your finished race car
- A Project Elements Submission Checklist which must include the official F1® Model Block holographic sticker if applicable

- **C2.9.1** Car(s) - each team must produce a minimum of two (2) race car
- **C2.9.2** Portfolios – each team must produce the following:
  - One (1) 'hard copy' 5-page maximum Design & Engineering Portfolio
  - One (1) 'hard copy' 5-page maximum Enterprise Portfolio.

Portfolios (excluding front and/or back covers) presented in an A3 (or similar) sized format for exhibition within the teams' pit display. Refer to ARTICLE C5 & C6 of these regulations along with the Design & Engineering and Enterprise judging scorecard for portfolio specification and content requirements.

- **C2.9.3** Pit Display - each team will be provided with a dedicated exhibition style space for set-up of their pit display elements. The specific style and size of this space will be announced in supplementary event competition regulations. Refer to ARTICLE C8 for further pit display specifications and content requirements.
- **C2.9.4** Verbal Presentation - teams will be required to deliver a Verbal Presentation in relation to their project to the Judges. The presentation must not last longer than **10 minutes**. Teams must bring their own laptop with any slide show or other multimedia files that need to be shown as part of their Verbal Presentation.
- **C2.9.5** Project Element Submission Checklist – teams must complete the checklist (please refer to Appendix ii) and attach their official F1 Model Block holographic sticker (if applicable) for submission at the event.

C2.10 Team registration at the event

- **C2.10.1** Teams will be required to register with STEM Racing once arriving for the National Finals event. At this registration, teams will be issued with a detailed event welcome pack. The student team manager and supervising teacher for each team should attend.
- **C2.10.2** The National accreditation material issued will include the official STEM Racing 30x15mm car decals, for teams that have not manufactured their own. These decals must be fitted to each car by the team following registration and prior to the submission of their project elements.

C2.11 Submission of STEM Racing car(s)

Once race-ready car(s) have been submitted, they are considered as being in Parc Fermé.

C2.12 Team names

No teams participating in the challenge are permitted to use any of the Formula One Word Marks (*F1, FORMULA 1, FIA FORMULA ONE WORLD CHAMPIONSHIP, GRAND PRIX and related marks are trademarks of Formula One Licensing BV, a Formula*

1 company. All rights reserved) in their team name, logo, domain name, and/or any social media handle. For example, "Infinity F1" is not allowed and should be changed to something similar such as "Infinity" or "Team Infinity".

C2.13 Benefit of doubt

The chair of judges will, where appropriate, seek to use 'benefit of doubt' when the assessment of compliance is marginal or unclear. In this situation, teams will be given the benefit of doubt rather than a firm penalty if a penalty cannot be clearly measured or identified.

C2.14 Spirit of the competition

Teams are expected to act in the spirit of the competition, both before and during any STEM Racing events. Any team deemed by the chair of judges to be acting outside of the spirit of the competition, can be removed from certain or all aspects of the competition. For example, a team attempting to exploit the technical regulations to their advantage may, at the discretion of the chair of judges, be removed from racing and receive no points for this activity.

The spirit of the competition is simple; embrace and respect the rules and regulations, do your very best to compete legally and fairly, while contributing positively to STEM Racing. Make friends, create positive relationships, network professionally and enjoy yourselves.

ARTICLE C3 – COMPETITION AND JUDGING FORMAT

C3.1 Competition program

- **C3.1.1** Each team will be judged as per the competition program. The competition program will be formulated by STEM Racing to best and fairly accommodate all judging and other competition activities. Teams will rotate around judging activities as per this program, with each rotation usually of 15 minutes in duration.
- **C3.1.2** Judging Streams – the competition program will normally be divided into two parallel judging streams (Stream A and Stream B), to help ensure quality judging time intervals within the event time constraints. A number of strategies are implemented within the judging process, including judge briefings and judge reviews for cross-moderation to ensure there is consistency across the judging streams.

C3.2 Judging categories

There are six (6) main judging categories, each with its own team of judges and specified judging activities as detailed in further articles.

- Specification and Scrutineering Judging
- Design and Engineering Judging
- Enterprise Judging
- Verbal Presentation Judging
- Brand Identity Judging
- Racing

C3.3 Judging scorecards

The STEM Racing judging scorecards provide detailed information in relation to what the Judges will be looking for. They include key performance indicators which are referred to by the judges in awarding points during judging activities. The judging scorecards can be found from p16 of this document, alongside guidance for the corresponding judging category. Reading the scorecards carefully is important. They provide critical information for teams as to what needs to be presented for each judging category.

The judging scorecards are not to be viewed as assessment criteria but are for the purpose of ranking teams at STEM Racing events. Marks given may differ between events, so scores should not be used exclusively to determine the strengths and weaknesses of a team.

C3.4 National Champions

The STEM Racing Poland National Champions trophies will be awarded to the team with the highest total score, sum of all judging categories (ARTICLE C3.5). In the case of a tied points score, the team with the highest racing score will be determined the winner.

C3.5 Point allocations

Points will be allocated differently between the online qualifiers and National Finals. Both tables can be found here. The scorecards for Design and Engineering, Enterprise and Brand Identity apply both to the online qualifiers and National Finals.

National Finals

Points will be awarded to teams across six (6) categories with maximum possible scores as detailed in the following table:

Specification and Scrutineering Judging (170 points)	
Specifications	110 points
Engineering Drawings	20 points
Renderings	20 points
Quality of Finish and Assembly	20 points
Design and Engineering Judging (180 points)	
Design & Engineering Portfolio	180 points
Enterprise Judging (160 points)	
Project Management	80 points
Sponsorship & Marketing	80 points
Brand Identity Judging (100 points)	
Corporate Identity	40 points
Pit Display	60 points
Verbal Presentation Judging (160 points)	
Technique	60 points
Composition	40 points
Subject Matter	60 points
Racing (220 points)	
Time Trials	110 points
Reaction Racing	110 points
TOTAL	**990 points**

C3.6 Classification of Technical Regulations

- **C3.6.1** The technical regulations are classified as either: **GENERAL**, **SAFETY**, **PERFORMANCE**. Please refer to the Technical Regulations for more information on compliance and penalties.

GENERAL	SAFETY	PERFORMANCE
Regulations that shape the way the car fundamentally looks and works, vital to the style of STEM Racing car.	Mandatory rules that govern the safe running of the car. Cars must meet these rules to be considered 'safe to race'.	Rules that have a direct impact on the performance of the vehicle, these typically carry the heaviest penalties.

- **P3.6.2** All Performance regulations are highlighted in yellow throughout the Technical Regulations document.

Judging:

Criteria and the scorecards...

ARTICLE C4 – SPECIFICATION & SCRUTINEERING JUDGING (170 points)

C4.1 What will be judged?

Scrutineering judging is a detailed inspection process where all race cars plus any optional replacement components are assessed for compliance with the STEM Racing Technical Regulations. The A4 Engineering Drawings, A4 Renderings and quality of finish & assembly will also be assessed. **Refer to the scrutineering and specification judging scorecards for scoring details.**

- **C4.1.1** Optional replacement components must be identical to those fitted to all race cars and must be submitted with the car. Only the following replacement components are permitted:
  - Rear wing/support structure – maximum of three (3)
  - Front wing/support structure and / or nose cone – maximum of three (3)
  - Wheel/wheel support system – maximum of three (3) car sets

  Submitted replacement components that are determined by the judges to not be identical to that which is fitted to the car will not be allowed to be used. Submitted components will remain in Parc Fermé and only be handed back to the team if needed during racing and / or car servicing.

C4.2 Team preparation

Teams must ensure that their car(s) and any optional replacement components are complete and ready for specification judging and racing before they are submitted. At the Polish National Finals, teams must also submit an electronic copy of all specified project data such as scrutineering engineering drawings, which may all be referenced. *For more information, refer to ARTICLE C2.9.*

C4.3 Who needs to attend?

Specification & Scrutineering judging is a closed activity that no team member or supervising teacher may attend. At Polish National Finals, for selected teams there will be a specification review session scheduled that must be attended by the team manager, team design and manufacturing engineers as a minimum.

C4.4 Judging process / procedure

Teams begin specification judging with a full allocation of 110 points. Any infringements of the Technical Regulation articles, on either car, will result in points being deducted as detailed in the Technical Regulations.

There are two (2) parts to the specification judging process.

A. **Specifications** – this is conducted within the confines of Parc Fermé, where the specification Judges will scrutineer all cars submitted and optional replacement components for compliance to the Technical Regulations. A series of specially manufactured gauges will be used to broadly check compliance. Accurate measuring tools, such as Vernier callipers will then be used to closely inspect any dimensions found to be near to dimensional limits per the initial gauge inspection. Scrutineering commences immediately, as soon as cars and optional replacement components are submitted.

B. **A4 Engineering Drawings & Renderings –** these documents are used along with the car(s) to assess Engineering Drawings, Rendering and Quality of Finish & Assembly as on the Scrutineering Judging scorecard - this is conducted within the confines of Parc Fermé, where the specification Judges will assess both cars as per the Scrutineering scorecard.

The specific areas to be assessed are described on the scorecard and specifications sheets on the following pages.

C4.5 Safe/Fit to race fix

At Polish National Finals, a special 20-minute car service time will commence prior to the start of racing, for any teams judged during initial scrutineering to have incurred a regulation failure from the list below. Cars must meet these rules to be considered 'Safe/Fit to race. If during this service time the car can be modified to comply with the failed regulation(s), the team will then only incur half the penalty points for that infringement, without being classified as having incurred a **SAFETY** infringement.

Scrutineering Judging Scorecard

Team Number:
Team Name:
School:

Scrutineering				
	Low band	**Middle band**	**High band**	**SCORE**
Engineering Drawings	Limited detail, Little or no annotation	Third angle orthographic projection. Excessive or insufficient detail	Third angle orthographic projection and un-rendered isometric view or similar. Additional views to show sufficient detail. Parts list / bill of materials and regulation compliance shown	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Rendering	Basic use of colour and 3D to show finished car	Well-proportioned full colour 3D renders showing more than 1 view. Detail close to final car.	Many different views. Very close match to final car including branding. Fitting environment and lighting. High end drawing / rendering technique	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Quality of Finish and Assembly	Reasonable finish with some inconsistencies	Good overall finish quality and assembly with attention to details	Excellent finish quality on all components. Very high attention to detail across all assembly and finishing. Two cars are identical	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Scrutineering Total =	/60

Notes:

Specifications Score Card

Please enter ✓ for a pass and **F** for a fail

(CO_2) – measured with full 8g CO_2 cartridge

Team Number:

Team Name:

Sample School:

Reg	Regulation Overview		Min/Max Quick Guide	Penalty per car	Initial Scrutineering Car A	Initial Scrutineering Car B	Notes
ARTICLE D3 – FULLY ASSEMBLED CAR							
D3.1.1	Designed and engineered using CAD / CAM		Check Portfolio	-5			
D3.1.2	Body manufactured using CNC only		Check Portfolio	-5			
D3.1.3	STEM Racing holographic sticker		Check submission	-5			
D3.1.4	Both Cars Identical		Visual Check	-5			
D3.2.1	Safe Construction – Specification judging		Safe to race at Scrutineering	-10			
D3.3	Undefined features		Check D1.1	-20			
D3.4	Total length	PP+	Min: **170mm** Max: **210mm**	-5	mm	mm	
D3.5	Total Width	PP+	Max: **90mm**	-5	mm	mm	
D3.6	Total weight	PP+	Min: **60.0g**	-10	g	g	
D3.7	Status during racing		Nothing removed	-5			
D3.8	Replacement components		Check list	-5			
ARTICLE D4 – BODY							
D4.1	Body construction		F1 Model Block	-20			
D4.2	No-go-zone		Check Eng. Drawing	-25			
D4.3.1	STEM Racing Halo		Halo exits with dimensional changes	-5			
D4.3.2	STEM Racing Halo Visibility Front, Side and Plan view		Check views	-5			
D4.3.3	STEM Racing Halo Circular notch height		34.0mm (±1.0mm)	-5			
D4.3.4	STEM Racing Halo Safety Test		Load test	-5			
D4.4	STEM Racing Helmet		inlcuded	-5			
D4.5	STEM Racing logo decal location		Check size and location	-5			
				Assessed by: (Initials)			
				Checked by: (Initials)			

Page 1 Notes:

D Specifications Score Card

Please enter ✓ for a pass and **F** for a fail

(CO_2) – measured with full 8g CO_2 cartridge

Team Number:

Team Name:

Sample School:

Reg	Regulation Overview		Min/Max Quick Guide	Penalty per car	Initial Scrutineering Car A	Initial Scrutineering Car B	Notes
ARTICLE D5 - POWER UNIT CARTRIDGE CHAMBER							
D5.1	Distance from track surface	PP+	Min: **30mm** Max: **40mm**	-5	mm	mm	
D5.2	Power unit cartridge visibility (8g)	PP+	No obstructions in rear view	-10			
ARTICLE D6 – WHEELS							
D6.1	Number and location		**4, 2 x 2** / standard design	-25			
D6.2	Visibility (top, side and bottom views)		Not obscured	-25			
D6.3	Visibility in the front view	PP+	Only obscured below **20mm**	-10	mm	mm	
D6.4	Race track contact		All 4 wheels touching track	-2.5 PW	FL: FR: RL: RR:	FL: FR: RL: RR:	
D6.5	Rotation		Reasonably minimal effort	-5			
				Assessed by: (Initials)			
				Checked by: (Initials)			

Page 2 Notes:

D Specifications Score Card

Please enter ✓ for a pass and **F** for a fail

(CO_2) – measured with full 8g CO_2 cartridge

Team Number:

Team Name:

Sample School:

Reg	Regulation Overview	Min/Max Quick Guide	Penalty per car	Initial Scrutineering Car A	Initial Scrutineering Car B	Notes
ARTICLE D7 – FRONT WING						
D7.1	Description and placement	Refer D1.10	-25			
D7.2	Wing identification	Check Eng Drawing	-5			
D7.3	Construction and Rigidity	Span constant during racing + rigid	-5			
D7.4	Front wing location	In Front of FW CL	-10			
D7.5	Visibility of front wing	Visible from Front	-15			
D7.6.1	Front wing span PP+	Min: **60mm**	-5	mm	mm	
D7.6.2	Front wing chord	Min: **15mm** Max: **30mm**	-5	mm	mm	
D7.6.3	Front wing thickness	Min: **5mm** Max: **15mm**	-5	mm	mm	
ARTICLE D8 – REAR WING						
D8.1	Description and placement	F & R & Height (D1.10)	-25			
D8.2	Wing identification	Check Eng Drawing	-5			
D8.3	Construction and Rigidity	Span constant during racing + rigid	-5			
D8.4	Rear wing location	In Front of FW CL	-10			
D8.5	Rear wing height	Min: 35mm	-10			
D8.6.1	Rear wing span PP+	Min: **60mm**	-5	mm	mm	
D8.6.2	Rear wing chord	Min: **15mm** Max: **30mm**	-5	mm	mm	
D8.6.3	Rear wing thickness	Min: **5mm** Max: **15mm**	-5	mm	mm	
ARTICLE D9 – Tether Line Guides						
D9.1	Location	2 guides, **15mm** fore/aft CL's	-10			
D9.2	Internal dimension	Min: **3.5mm** Max: **6mm**	-5	mm	mm	
D9.3	Tether line guide safety	**200g test**	-10			
			Assessed by: (Initials)			
			Checked by: (Initials)			

Page 3 Notes:

ARTICLE C5 – DESIGN & ENGINEERING JUDGING (180 points)

C5.1 What will be judged?

The Design & Engineering judges will mark your 5-page Design & Engineering Portfolio so that they can assess the team's car design and use of CAD/CAM technologies along with the quality of manufacture of all race cars submitted.

C5.2 Team preparation

A laptop needs to be ready and taken to Design & Engineering judging along with any other items which may help the team explain any Engineering or manufacturing concepts. The Design & Engineering judges will have access to the car(s) submitted for racing but will not have access to the team pit display for judging purposes. Preparation should include careful reading of the scorecard. The key performance indicators for the design process, application of CAD / CAM, analysis and associated data organisation, describe what the judges will be looking for.

C5.3 Who needs to attend?

This judging session must be attended by the team manager and team design and manufacturing engineers as a minimum.

C5.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the Design & Engineering scorecard. Judges will review the Design & Engineering portfolio in a 'closed to teams' session programmed before the commencement of scheduled judging sessions. The scheduled Design & Engineering judging interview session will focus on the overall Engineering and Design of the car. This is an informal interview where Judges will ask the team to demonstrate their CAD / CAM work and query teams on what they have done. The quality of car manufacture and car assembly will be judged during a separate 'closed to teams' session.

C5.5 Design & Engineering Portfolio requirements

The Design & Engineering portfolio must be in a printed 'hard copy' format or saved as a PDF of A3 or similar size. **Polish National Finals:** teams must also provide an electronic copy of their Enterprise and Design and Engineering portfolios to STEM Racing. Submission details will be provided to teams prior to the event.

Development Class: The portfolio is limited to **5 pages** of content, which **does not** include the front and back covers. This should be 5 single sided sheets. If a portfolio comprises more than 5 pages, the Judges will only assess the first 5 PRINTED pages after the front cover.

There MUST be content related to the use of CAM and CNC manufacturing included in the portfolio and this will be referenced by the Engineering Judges. An orthographic drawing and 3D render must also be included in the portfolio, refer ARTICLE C2.9. Content related to the car, design ideas, design development, research, testing and evaluation are commonly presented within the portfolio.

Please note: Front and back covers do not contribute towards the portfolio assessment in any way, these are purely presentation items.

The specific areas to be assessed are described on the scorecard on the following page.

Design & Engineering Scorecard

Team Number:
Team Name:
School:

	Low band	Middle band	High band	SCORE
Design & Engineering Portfolio Only Assessment				
Design Concepts	Single or basic hand sketched concepts	Multiple hand sketched concepts with links to research. Some evidence of physical 3D modelling	Several clearly annotated, hand sketched ideas for different car components. Experimentation of ideas using physical and CAD 3D modelling	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
3D Modelling	Basic application. Only final design 3D modelled	Appropriate 3D modelling in development stages. Dimensional constraints of F1® model block considered	Advanced use of physical and CAD 3D modelling techniques to develop final concept through iterative approach. Designed for manufacture considerations (i.e. fillets)	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Application of Computer Aided Analysis	Limited CFD/FEA analysis shown	Appropriate analysis shown. Results applied to development	Advanced and relevant. Virtual analysis integrated throughout design development	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Use of CAM/CNC	Limited evidence of CAM/CNC understanding	Effective use and understanding of CAM/CNC processes used	Evidence of excellent understanding of CAM/CNC technologies. Appropriate techniques and processes used to achieve manufacturing goals	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Other Manufacturing & Assembly	Limited manufacturing presented. Outsourcing with minimal understanding or justification	Manufacturing process and stages described. Appropriate use of manufacturing resources documented (i.e. tools, finishes, jigs, fixtures)	Details all manufacturing stages and processes. Quality assurance and workplace safety considerations evident. Appropriate outsourcing justified	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Research & Development	Limited evidence of R&D	Some scientific & mathematical theories and principles considered. Logical research-based design developments explained	Relevant R&D throughout the entire product design & development cycle, demonstrating high level CAD skills where appropriate. Design developments justified from research findings	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Testing	Limited evidence of testing	Limited testing. Some evidence of method and outcomes	Purposeful testing with method and outcomes documented. Evidence of virtual and physical testing on the fully assembled car and individual components	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Design Process Evaluation	Limited design process evaluation	Ideas or process evaluations at different stages	Excellent ongoing idea evaluations linked to improvement actions	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Document Presentation	Difficult to follow with basic presentation	Document clearly structured and well organised	Document has high impact and professional throughout. Consistent and clear organisation	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Design & Engineering Portfolio Only Assessment Total =	/180

Notes:

ARTICLE C6 – ENTERPRISE JUDGING (160 points)

C6.1 What will be judged?

The Enterprise judges will mark your 5-page Enterprise Portfolio. Judges will be looking for the following:

- Project Management (how your team has planned and carried out all the work required, following processes and working together as a team to complete your objectives)
- Sponsorship & Marketing (the activities you have carried out to raise awareness, support and finance to help your team function in order to complete the project)

C6.2 Team preparation

Each team must prepare an Enterprise Portfolio as per ARTICLE C2.9. Most importantly, teams need to read the Enterprise judging scorecard carefully to ensure they have met all the areas to be assessed. It is each team's decision how and where these areas are presented. Teams should be mindful of the time constraints of judging when making these decisions.

C6.3 Who needs to attend?

All team members must be present during the Enterprise judging session.

C6.4 Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the Enterprise scorecard. Judges will review the Enterprise portfolio in a 'closed to teams' session programmed before the commencement of scheduled judging sessions. The scheduled Enterprise judging interview session will focus on the overall Project management and Sponsorship & Marketing activities conducted by the team. This is an informal interview where Judges will ask the team to demonstrate their processes and query teams on what they have done.

C6.5 Enterprise Portfolio requirements

The Enterprise portfolio must be in a printed 'hard copy' format or saved as a PDF of A3 or similar size. **Polish National Finals:** teams must also provide an electronic copy of their Enterprise and Design and Engineering portfolios to STEM Racing. Submission details will be provided to teams prior to the event.

Development Class: The portfolio is limited to **5 pages** of content, which **does not** include front and/or back covers. This should be 5 single sided sheets. If a portfolio comprises more than 5 pages, the Judges will only assess the first 5 PRINTED pages excluding the front cover.

C6.6 Project Management Guidebook

As mentioned previously in this document, STEM Racing has produced a guidebook in partnership with Project Management Institute Educational Foundation (PMIEF), to help equip teams with industry-level terminology and techniques to employ in their project work. Using the correct terminology is important, but just as crucial is understanding the meaning of these phrases and words. Teams are advised to learn the basics of professional Project Management through the guide, to increase their chances of successfully achieving the higher KPI's in the Enterprise scorecard. Using the guide is not mandatory, nor is it a comprehensive guide to all the activities your teams may undertake, but we have

created a document that can add to your teams understanding of much of the Project Management work they already do, while giving a few ideas to help them improve further. STEM Racing would like to acknowledge the detailed and professional work of PMIEF in helping us create this document.

The STEM Racing Project Management Guidebook can be downloaded directly from **https://www.stemracing.com/rules--regulations.html**.

The specific areas to be assessed are described on the scorecard on the following page.

Enterprise Scorecard

Team Number:
Team Name:
School:

	Low band	Middle band	High band	SCORE
Project Management				
Scoping and Project schedule	Limited evidence of a scope statement or tasks to be completed	Evidence of a project scope statement and schedule, showing a breakdown of time required to complete essential tasks	Clear statement of project scope and project schedule, showing detailed breakdown of all tasks. Detailed Gantt chart created to identify all tasks, dependencies and time estimations	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Roles and Responsibilities	Limited evidence of clear roles and responsibilities within team	Team roles and responsibilities identified, with some evidence of task and/or activity breakdown	Team members identified and a highly structured team created with clearly defined job functions and appropriate responsibilities. Evidence of a Responsibility Assignment ('RACI') Matrix	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Budget and Risk Management	Limited evidence of strategies to manage budget and/or risk	Some evidence of budgeting. Evidence of risk identification and response management plans in place	Clear evidence of budgeting and use of accounting methods to track expenditure. Clear evidence identifying all relevant risks, area(s) of impact and response planning.	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Communication, Monitoring & Controlling	Limited or isolated evaluation of project status	Ongoing evaluation of project status. Evidence of problems identified and suggested solutions	Excellent ongoing communications between team members and stakeholders, documenting tasks signed off. Issues are identified and resolved through regular 'Status Reports'	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Project Management Total	/80

Sponsorship & Marketing				
Marketing	Limited evidence of marketing activities	Some evidence of marketing strategy, delivery and marketing materials	Clear, well planned marketing activities and delivery of an effective marketing strategy, including development of suitable marketing materials	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Sponsorship	Limited evidence of strategy to achieve sponsorship	Sponsor/partner hierarchy and benefits identified. Some evidence of return of investment (ROI) to relevant sponsors	Sponsor/partner hierarchy and benefits detailed and justified. Range of relevant sponsors/partners showing mutually beneficial relationships. Creative activities linked to return of investment (ROI)	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Digital Media	Limited or low level of documented planning, understanding and execution	Some evidence of strategic planning and execution in line with documented strategy, consideration for audience and platforms	Clear, structured, well-communicated digital strategy with execution in line with documented plans, proactive use of platforms, creativity and audience engagement	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Document **Presentation**	Difficult to follow with basic presentation	Document clearly structured and well organised	Document has high impact and professional throughout. Consistent and clear organisation	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Sponsorship & Marketing Total	/80

Project Management Total + Sponsorship & Marketing Total = Enterprise Total =	/160

Notes:

ARTICLE C7 – VERBAL PRESENTATION JUDGING (160 points)

C7.1 What will be judged?

- Presentation technique (how your team comes across during the presentation)
- Presentation composition (how well you structure your presentation)
- Subject Matter (the topics which need to be talked about)

C7.2 Team preparation

Each team is required to prepare a **10-minute** Verbal Presentation as per the requirements at ARTICLE C2.9.4. Any multimedia content, slides etc. must be saved on and shown, using the team's own laptop. Teams must have all presentation resources tested and ready with them for Verbal Presentation judging. Most importantly, teams should read the Verbal Presentation judging scorecard carefully to ensure their verbal presentation features all elements and content that the judges will be looking for.

C7.3 Who needs to attend?

All team members must be present during the Verbal Presentation judging session.

C7.4 Judging process / procedure

Verbal Presentation judging is scheduled for the same duration of other judging sessions, usually 15 minutes. Teams will be given an opportunity at the start of their time to set-up and test their laptop and any other presentation technologies and resources. The team will inform the judges when they are ready to begin. The judges start timing the 10-minute duration and will provide a discreet time warning signal when one minute of presentation time remains. The team will be asked to cease presenting when the time limit has been reached. At the conclusion of the team's presentation time, the judges may choose to provide some feedback and / or ask any clarifying questions they feel necessary.

C7.5 Verbal presentation judging provisions

STEM Racing will provide a dedicated private space, such as a small meeting room, where each team will deliver their presentation to the judges. This space will include a data projector, screen and multimedia sound system. These will be in fixed positions but usually with sufficient cable length to allow teams some freedom for choosing where they wish to locate their laptop. A single table will also be made available with its use and location in the presentation space being optional.

C7.6 Verbal presentation video recordings

The Verbal Presentations of all teams may be video recorded by STEM Racing for the purpose of judging review and/or post event publicity and promotional purposes by STEM Racing.

The specific areas to be assessed are described on the scorecard on the following page.

Verbal Presentation Scorecard

Team Number:
Team Name:
School:

	Low band	Middle band	High band	SCORE
Technique				
Visuals	Little use of aids	Some aids used effectively	Highly professional aids effectively improve communication	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Team Contribution	Minimal team participation	Good contributions from most team members	Excellent teamwork with all members participating effectively	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Energy / Engagement	Artificial and/or low energy, with minimal engagement	Speakers generally enthusiastic with lively delivery. Some audience connection at times	Passionate with effective and appropriate levels of liveliness. Audience fully engaged and excited throughout presentation	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Technique Total	/60

Composition				
Concept Clarification	Several concepts lacked clarification	Clear and appropriate concept explanations	Everything presented was understood through excellent explanations	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Time / Presentation	Too fast or ran out of time. No structure presented	Good timing. Balanced topic depth and pace. A basic structure / outline provided and could be followed by audience	Ran on time or under. Excellent balance of depth for each topic. Clear presentation outline / overview. Excellent connections between topics and easy for audience to follow	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Composition Total	/40

Subject				
Innovation	Little project innovation presented	Project innovations described and justified	Originality. Clever innovations with high positive project impact	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Collaboration	Little collaboration discussed	Links with industry or higher education described	Collaborations justified with links to learning and project outcomes	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
STEM Racing Learning Experiences	No real reflections discussed	Good explanation of some learning outcomes with reference to career aims	Compelling accounts of how the competition has impacted on life skills and career aspirations for a range of team members	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Subject Total	/60

Technique Total + Composition Total + Subject Total = Verbal Presentation Total =	/160

Notes:

ARTICLE C8 – BRAND IDENTITY JUDGING (100 points)

C8.1 What will be judged?

The Brand Identity judges will assess each teams' Pit Display and overall Corporate Identity, through all project elements.

C8.2 Team Preparation

Each team must prepare a Pit Display as per ARTICLE C2.9. Most importantly, teams need to read the Brand Identity judging scorecard carefully to ensure that all areas to be assessed are included within the design of their Pit Display and/or additional competition project elements. The judges will assess each teams' Corporate identity through the Pit Display and all other project elements, so it's important to have a continuous theme throughout all your work.

C8.3 Who needs to attend?

All team members must be present during the Pit Display judging session.

C8.4 Judging process / procedure

The Brand Identity judging will take place at each teams Pit Display. The Judges will usually introduce themselves then ask the team to stand clear of their display so the Judges can conduct assessments, while asking further questions about the work. Outside judging slots, the Judges will also be given some time to conduct pre-judging and review of each team's Pit Display and other competition elements, in order to accurately assess Corporate Identity.

C8.5 Pit Display setup and parameters

- **C8.5.1** At Polish National Finals, teams will be given a classroom style table to present their pit display.
- **C8.5.2** At Polish National Finals, no part of the teams completed Pit Display is allowed to protrude beyond the physical dimensions of their allocated pit space. This includes anything that might protrude above the pit space highest point e.g. flags.
- **C8.5.3** **ONLY** student team members are permitted to set-up their pit displays. There must be no supervising teacher / adult or other outside assistance, unless deemed by STEM Racing to be a health and safety issue.

IMPORTANT HEALTH & SAFETY: Please ensure that Health and Safety measures are considered when working on all aspects of your Pit Display. STEM Racing reserves the right to apply a penalty of **up to 50 points** at the discretion of the Chair of Judges for unsafe activity.

- **C8.5.5** STEM Racing and / or the Chair of Judges may instruct a team to take action to reduce noise or remove display inclusions deemed to be inappropriate. STEM Racing will instruct teams to remove or alter any display inclusions considered to be a safety hazard.
- **C8.5.6** Please note, at the Finals there may be no availability of power for teams, so it is advisable not to rely on this assumption for your display.

The specific areas to be assessed are described on the scorecard on the following page.

Brand Identity Scorecard

Team Number:
Team Name:
School:

	Low band	Middle band	High band	SCORE
Pit Display				
Sustainability	No or limited sustainability considered.	Sustainability strategy signposted with some evidence of implementation.	Sustainability strategy and activities clearly evidenced, showing consideration of economic, environmental, and social factors.	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Visual appearance	Limited, relevant graphics or advertising methods employed	Attractive display, including relevant graphic elements and implementation of some advertising methods	Professional looking display, incorporating highly effective graphics, use of ambient advertising and use of lighting to enhance display	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Pit Display Content	Limited detail, with some basic items of relevance	Clear and effective use of relevant items to engage visitors. Appropriate multimedia used to enhance display	Clean, well-organised and interactive. Excellent integration of technology and multimedia, with an appropriate range of tactile display items	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Pit Display Total	/60

Corporate Identity				
Graphic Identity	Inconsistent, limited or obscure graphic identity	Effective brand identity consistent through various project elements e.g. car matches team uniform	Excellent and highly effective brand identity. Visual 'brand' consistently applied through all project elements, with an appropriate team dynamic	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Team Identity	Limited consideration given to establishing a team identity	Some consideration given to choosing an appropriate team name, motto and organisational style	Excellent and highly effective team name, trademark and operating style, in line with the team's graphic identity. Clear buy-in from all members to a set of established common aims	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	

Corporate Identity Total	/40

Pit Display Total + Corporate Identity Total = Brand Identity Total =	/100

Notes:

Racing:

How it works...

ARTICLE C9 – RACING (220 points)

C9.1 Team preparation

- **C9.1.1** Teams should be familiar with the operation of the STEM Racing Race System. There will normally be a section demonstration track within the venue where teams can practice race starts during free time prior to their scheduled races.
- **C9.1.2** Manual / driver starts - one or more team members (driver/s) must be appointed for launching of the teams' car using the manual launch method. The driver must stand within the dedicated starting area.
- **C9.1.3** Finish line management - at least one member of the team must be appointed as responsible for managing the finish line deceleration system or teams' own system (refer C9.8.2) and return of car along the track to the start.
- **C9.1.4** Start line car staging – one team member may be appointed as being responsible for 'aligning' the car. This team member is only permitted to set the alignment of the car behind the start line, with respect to the launch pod and track under close supervision from the racetrack Judges. Team members are NOT permitted to interfere in any way with the CO_2 cartridge or vertical alignment of the launch pod. This process must be completed within a time limit of 30 seconds. Appointment of this team member is optional. All four wheels must be in contact with the track surface after completion of the car staging time. The race Judges can assist or perform this task for the team.
- **C9.1.5** Teams must ensure that both cars are race ready, a car service session will be provided before the next race event. If a teams' car is damaged beyond achievable repair, then teams will forfeit any races that the car would have been used for.

All team members must be present during their scheduled racing sessions and should assemble at the track start for briefing by the racetrack judges at their scheduled time.

C9.2 Reaction race procedure

Cars are launched in manual (driver launched) mode with four (4) races total per team, two (2) races in each lane. The TOTAL RACE TIME displayed, and the REACTION TIME displayed for each race is recorded. The reaction races will be conducted as follows:

1. Teams race in order as shown in the competition program. To begin racing, the lowest team number will start in lane 1. All cars will be loaded onto the track, Car A first then Car B
2. One team member to track finish for deceleration system control
3. Judge arms launch pod - SAFETY ON – makes initial launch pod adjustments
4. Race 1 (Car A) - Judge sets cars on track / tether line and inserts CO_2 cartridge
5. A team member is then allowed 30 seconds to 'fine tune' the alignment of their car, please see C9.1.4 for more detail
6. Driver and team stand trackside with corresponding lane start trigger
7. Judge checks deceleration system is ready, track is clear for racing, switches launch pod - SAFETY OFF
8. Judge presses the start system reset button – cars are launched by driver pressing start trigger
9. Judge records TOTAL RACE TIME and REACTION TIME displayed on start gate
10. Team member at finish moves car into storage zone at the end of the track
11. Race 2 (Car B) conducted in same lane as above, driver can be inter-changed as nominated
12. Team member at finish control returns car and empty CO_2 cartridge along track to the start with minimum handling
13. Judges remove cars from tether line and change lanes
14. Race 3 (Car A) and Race 4 (Car B), driver can be inter-changed as nominated
15. Cars removed from track and returned to Parc Fermé

C9.3 Reaction race scoring

All four (4) 'total race times' recorded from the reaction races are considered. The fastest of these four (4) times is used in the following formulae to calculate the points awarded:

- Fastest 'total race time' = 110 pts
- 2nd fastest 'total race time' = 105 pts
- 3rd fastest 'total race time' = 100 pts
- Slowest 'total race time' = 5 pts
- Base Time = 120% of 3rd fastest 'total race time'
- 4th fastest and all other teams score points using the following formula:
- Team Points = 5 + (95 / (Base Time – fastest 'total race time')) x (Base Time – teams fastest 'total race time')
- Any team with a best 'total race time' that is slower than the base time will score 5 points. To further discriminate between any teams scoring 5 points, a deduction of 1 point will be made for any did not finish (DNF) reaction race result

C9.4 Time Trial race scoring

The four (4) 'car race times' recorded during the reaction races will be considered. From these four (4) races, the team's 2nd and 3rd best **'car race times'** will be averaged. This average time is used in the following formulae to calculate the points awarded:

- Fastest average (avg.) time = 110 pts
- Second fastest avg. time = 105 pts
- Third fastest avg. time = 100 pts.
- 'Base Time' = 115% of the third fastest avg. time of all teams avg. times.
- Fourth (4th) to slowest avg. time score points using the following formula:

Team Points = 20 + (80/(Base Time – 3rd fastest avg.)) x (Base Time – teams avg.)

- Any team that has an average slower than the base time will score 20 points. To further discriminate between these teams, a deduction will be made of 5 points for any did not finish (DNF) time trial result
- If after discarding a team's fastest time there remains less than two (2) times from races finished, due to DNF's, the slowest time recorded is again input to the average equation until there are a total of four (4) times to average

C9.5 DNF (Did not Finish) race results

Damage or part separation occurring during a race, before the car crosses the finish line, (e.g. wheel or any other part of the car separating), or car not crossing the finish line at all, effects in a DNF race result. The Judges may refer to video evidence to verify a DNF result.

C9.6 False starts

- **C9.6.1** A false start (jump start) occurs when the driver presses the trigger button before the five (5) start gate lights have extinguished. This will be signalled with the outer red light above the lanes illuminating.
- **C9.6.2** All reaction false starts will incur a 2.5-point penalty and by default, forfeit that race. This penalty does not apply to knock-out racing.
- **C9.6.3** During knock-out racing – if one team false starts (jump starts), the other team should continue to race as normal. The team who false started forfeits that race, scoring a DNF and the other team's time is recorded. If both teams false start, the race counts as one of the two (2) runs.
- **C9.6.4** During any manual / driver starts, if a driver false starts and distracts the other driver the race will be re-run and the driver who caused the distraction will forfeit their race.
- **C9.6.5** Distractions outside of the race start area will be assessed by the lead track judge and track officials to determine if the race should be re-run. Spectators must keep noise down to a minimum and not use flash photography.

C9.7 Track, tether line and timing system information

- **C9.7.1** The STEM Racing Elevated Racetrack, supplied by Denford Ltd will be used. The official length of the track, from start line to finish is 20 metres. A monofilament tether line of diameter 0.6mm, fixed at the finish end, passes down the centre of each lane. At the start end the line passes through 90 degrees over a single pulley then attached to a 1.0kg mass suspended above the floor.

- **IMPORTANT: Teams are not permitted to add anything to the racetrack until 250mm after the finish line/gate.**
- **C9.7.2** Launch/Timing - The STEM Racing Launch/Timing System will be used for launching cars and timing races and driver reaction times to 1/1000th of a second.

C9.8 Car Deceleration system

- **C9.8.1** The Car Deceleration System acts to bring cars to rest once crossing the finish line. STEM Racing will provide a standard Car Deceleration System, consisting of tapered brushes positioned behind the finish line of each lane.

- **C9.8.2** Teams may supply their own deceleration system and the team will be responsible for its management. Any system supplied by a team must be simple to setup within 1 minute and must not impede the opposing track lane, race car or the race schedule in any way. The judges, at their discretion, can rule any system supplied by a team to be inappropriate and revert to use of the standard deceleration system.
- **C9.8.3** Deceleration systems must be located a minimum of 250mm after the finish line.

C9.9 CO_2 Race cartridges

CO_2 cartridges to be used for all competition races will be supplied by STEM Racing. Each CO_2 cartridge will be separately weighed before competition to ensure that all CO_2 cartridges used for races are within a weight range of 0.5 grams. All race cartridges will be kept in a temperature-controlled environment of 21 degrees Celsius.

C9.10 Car weight checks

Cars will have their weight checked at the racetrack prior to commencing a race event. This is done to ensure each car remains at a legal weight during all races. If a car is judged to have gone under weight whilst stored in Parc Fermé, the judges will add ballast to return the car weight to what it was when first submitted to Parc Fermé, without penalty.

C9.11 Judges handling cars

The race Judges will not be required to comply with any special car handling requests made of them by teams. This includes use of any special gloves or tools.

Details:

Things to be aware of...

ARTICLE C10 – CAR REPAIRS AND CAR SERVICING

C10.1 Car repairs

- **C10.1.1** All damage issues and related repair work during racing is at the Judge's discretion and may be referred to the scrutineering Judges and/or Chair of Judges for a final decision.
- **C10.1.2** No items can be removed or added to a car during racing, other than CO_2 cartridges, except in the case of a repair.
- **C10.1.3** If any race car sustains damage during racing and this damage is ruled to be related to engineering deficiencies, the damage can be repaired using any of the defined replacement components. Any repairs using replacement components that can be **safely** performed in under 30 seconds will not incur any race penalty points. A timer will start when the race official places the damaged car on the official repair table. If the repair takes longer than 30 seconds, doesn't use the defined replacement components or the car is not race ready, then **a 5-point penalty will be applied**. A repair time limit of 120 seconds (2 minutes) will be applied, if the car is not race ready at the end of this time then any further repairs must take place in the next service session This may include but not be limited to car body, wings & wheels being damaged as part of racing including damage occurring within the deceleration area.
- **C10.1.4** Engineering deficiencies may include but not limited to damage to car body, wings & wheels as part of racing including damage occurring within the deceleration area.
- **C10.1.5** Curing time for adhesives must be included in 30 second repairs.
- **C10.1.6** Tool kits are allowed to be taken racing. Teams must supply all of their own tools and other necessary resources. Judges will not be able to assist teams with any additional resource requirements
- **C10.1.7** If the Judges rule that damaged sustained was not due to engineering deficiencies, immediate repairs will be permitted without penalty.
- **C10.1.8** No penalty is applied for damage incurred during knock-out racing or a car's final race of any race event.

ARTICLE C11 – PROTESTS

C11.1 Submitting a protest

Any protest issues must be submitted by the team manager to an Event Director, no more than 10 minutes after the conclusion of the final scheduled race event. This will be registered and immediately lodged with the Chair of Judges. Any protest or appeals submitted after this time may be disregarded. All protests must be lodged in writing via the official protest form available from the Event Directors. The Chair of Judges decision related to any protest is final.

C11.2 Unsuccessful protests

Teams should carefully consider their grounds for submitting a protest or appeal. Any protest or appeal that is unsuccessful, with the Judges initial decision remaining unchanged, will result in the team having a **15-point penalty** applied against their total score.

ARTICLE C12 – JUDGES

C12.1 Overview

At National Finals, there will be a minimum of five (5) teams of judges plus officials that form the entire judging panel. Each judging team will have one (1) judge appointed as the Stream Lead Judge. Judges are education and industry experts invited by STEM Racing. All judges sign a 'declaration' to ensure there are no conflicts of interest with respect to judges and the teams they are judging.

C12.2 Chair of Judges

This is an independent authority appointed by STEM Racing who oversees all judging procedures. The Chair of Judges will determine the final judging decision where a protest has been submitted or other judging issue needs resolution. The Chair of Judges will also preside over a meeting of all Lead Judges to ratify the final results along with nominations and winners for relevant awards.

C12.3 The Judging teams

- **C12.3.1** Specification and Scrutineering Judges - will assess all race cars as per the Specification and Scrutineering scorecards.
- **C12.3.2** Design and Engineering Judges - will assess each team as per the Design & Engineering scorecard.
- **C12.3.3** Verbal Presentation Judges – will assess each team as per the Verbal Presentation scorecard.
- **C12.3.4** Enterprise Judges **–** will assess each team as per the Enterprise scorecard.
- **C12.3.5** Race Judges – will oversee and rule on all race events and any incidents.
- **C12.3.6** Car servicing officials – will oversee all car service activities and rule on any infringements that may occur.
- **C12.3.7** Marketing Judges – will assess each team's use of marketing and social media.

C12.4 Judging Decisions

THE DECISION OF THE JUDGES AND OFFICIALS IS FINAL.

Appendix:

1. Scoring matrix
2. Project Submission Checklist

APPENDIX i: SCORING MATRIX

Please find below how each award is calculated and which judging categories contribute to each award.

Judges	Heading	Subheading	National Champions	2nd Place	3rd Place	Fastest Car Award	Best Engineered Car	Sponsorship & Marketing Award	Team Identity Award	Pit Display	Verbal Presentation	Research & Development	Judges Choice	Lightning Reaction Time	Project management	Women in Motorsport	Scrutineering Award
Scrutineering	Scrutineering	Specifications	●	●	●		●						●			●	●
		Engineering Drawings	●	●	●		●						●			●	●
		Rendering	●	●	●		●						●			●	●
		Quality of Finish and Assembly	●	●	●		●						●			●	●
Design & Engineering	Design & Engineering Portfolio	Design Concepts	●	●	●		●					●	●			●	
		3D Modelling	●	●	●		●					●	●			●	
		Application of CAA	●	●	●		●					●	●			●	
		Use of CAM/CNC	●	●	●		●						●			●	
		Other Manufacturing & Assembly	●	●	●		●						●			●	
		Research & Development	●	●	●		●					●	●			●	
		Testing	●	●	●		●					●	●			●	
		Design Process Evaluation	●	●	●		●						●			●	
		Quality & Clarity	●	●	●								●			●	
Enterprise	Project Management	Scoping and Project schedule	●	●	●								●		●	●	
		Roles and Responsibilities	●	●	●								●		●	●	
		Budget and Risk Management	●	●	●								●		●	●	
		Communication, Monitoring & Control	●	●	●								●		●	●	
	Sponsorship & Marketing	Marketing	●	●	●			●					●			●	
		Sponsorship	●	●	●			●					●			●	
		Digital Media Strategy	●	●	●			●					●			●	
		Document Presentation	●	●	●			●					●			●	
Brand Identity	Pit Display	Sustainability	●	●	●					●			●			●	
		Visual Appearance	●	●	●					●			●			●	
		Pit Display Content	●	●	●					●			●			●	
	Corporate Identity	Team Identity	●	●	●			●	●				●			●	
		Graphic Identity	●	●	●			●	●				●			●	
Verbal Presentation	Technique	Visuals	●	●	●						●		●			●	
		Team Contribution	●	●	●						●		●			●	
		Energy / Engagement	●	●	●						●		●			●	
	Composition	Concept Clarification	●	●	●						●		●			●	
		Time / Presentation	●	●	●						●		●			●	
	Subject	Innovation	●	●	●						●		●			●	
		Collaboration	●	●	●						●		●			●	
		STEM Racing Learning Experiences	●	●	●						●		●			●	
Racing	Racing	Time Trials	●	●	●	●							●			●	
		Reaction	●	●	●	●							●	●		●	
		Knockout	●	●	●								●			●	
		Damage During Racing Penalties	●	●	●		●						●			●	

APPENDIX ii

	Key: fill indicates those project elements that should also be submitted digitally prior to the event.
Team Number:	
Team Name:	
School:	

Project Element	PRE-EVENT: (Team members)	AT EVENT: (STEM Racing Staff)	COMMENTS: (Completed by STEM Racing Officials only)	
1 x 5 Page Design & Engineering Portfolio	TICK DIGITAL SUBMISSION	TICK		
1 x 5 Page Enterprise Portfolio	TICK DIGITAL SUBMISSION	TICK		
A4 Engineering drawings	TICK DIGITAL SUBMISSION	TICK		
A4 Car renderings	TICK DIGITAL SUBMISSION	TICK		
Pit Display	TICK	TICK		
Verbal Presentation	TICK	TICK		
1 x Car A (Green dot applied by SR)	TICK	TICK	Weight: g	
Rear Wing / Support Structure (Optional)	TICK	TICK	Max: 3 sets Number Submitted:	
Front Wing / Support Structure (Optional)	TICK	TICK	Max: 3 sets Number Submitted:	
Wheel / Wheel Support System (Optional)	TICK	TICK	Max: 3 car sets Number Submitted:	
2 x Official F1 Model Block Holographic Stickers (if applicable)	TICK	TICK	Car A sticker here	Car B sticker here (NF)

Sign-off by	Name	Signature
Team Manager:		
STEM Racing Official:		

Please make sure you have also read the corresponding STEM Racing Poland Technical Regulations

Work hard, see you on the track!