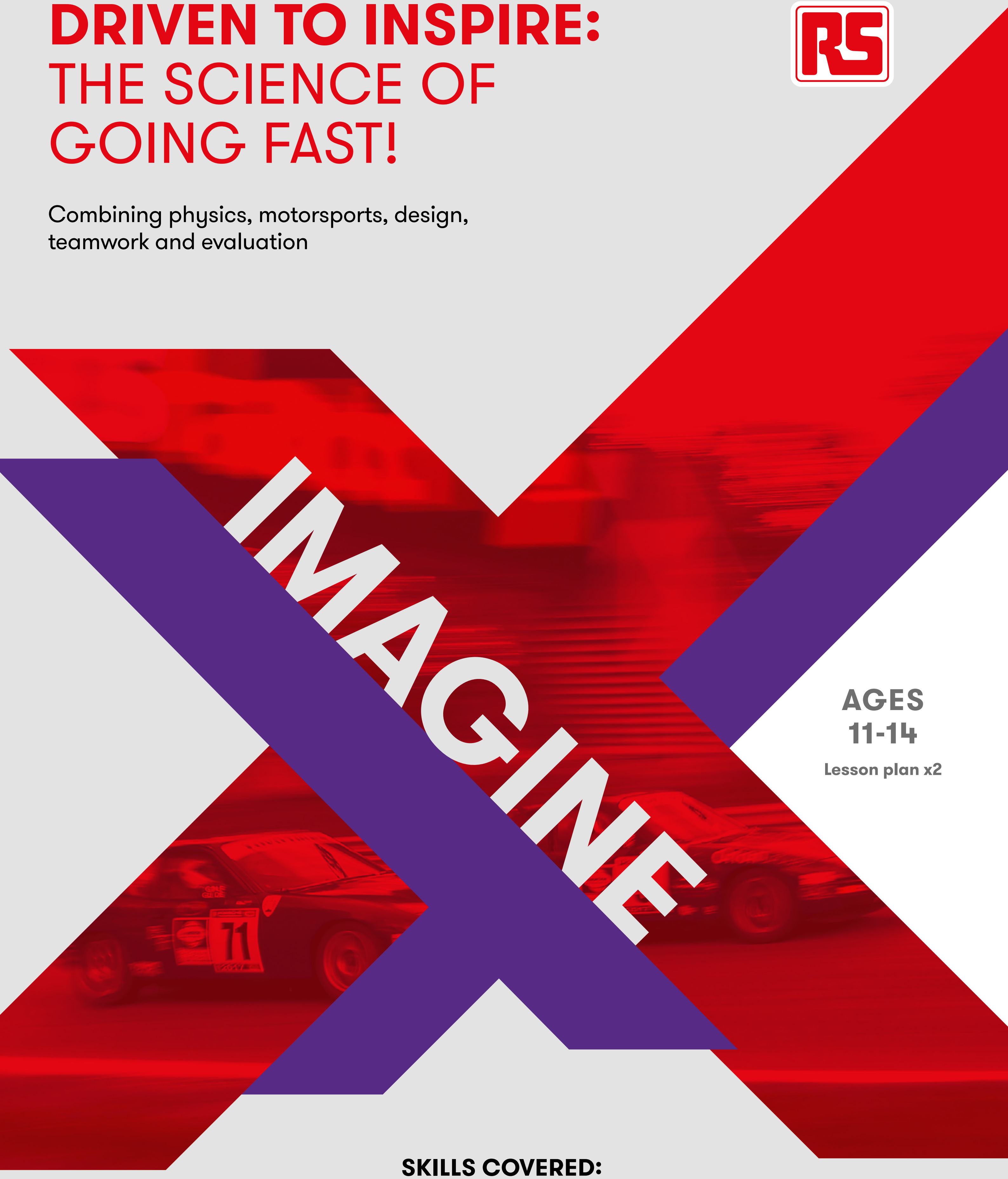
POWERED BY RS

DRIVEN TO INSPIRE: THE SCIENCE OF GOING FAST!

Combining physics, motorsports, design, teamwork and evaluation

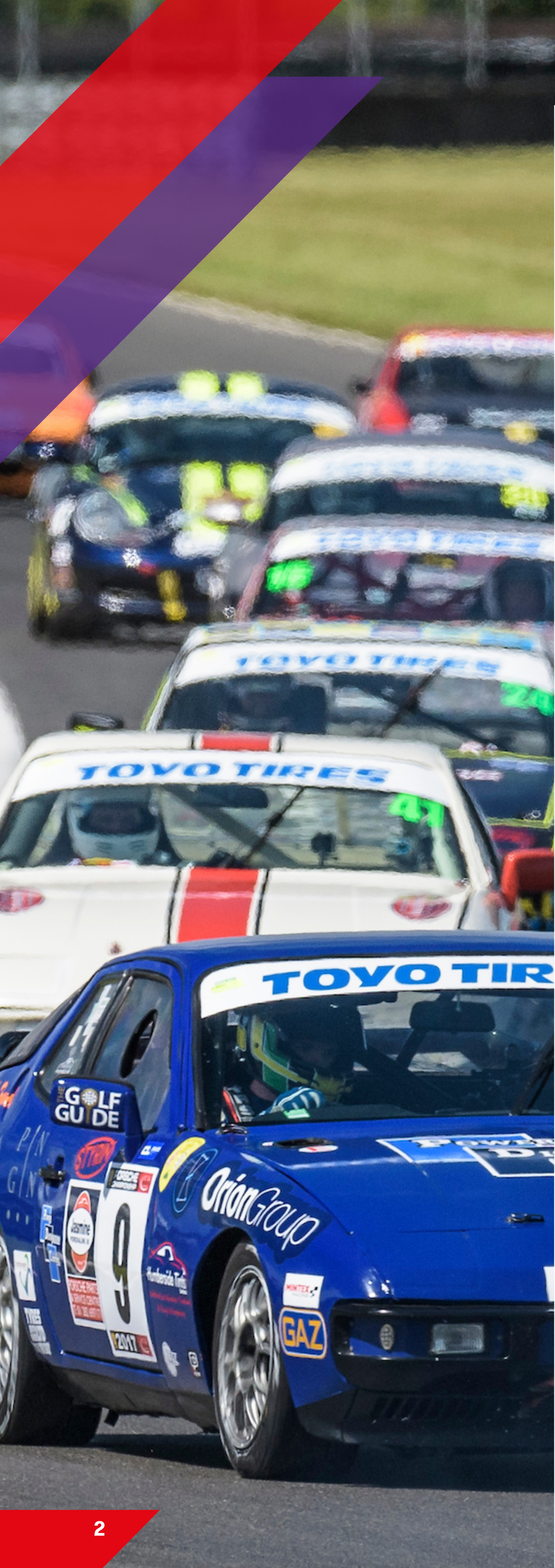


AGES 11-14

Lesson plan x2

SKILLS COVERED:

- Identifying racing track conditions and the appropriate car parts
- Working as part of a team
- Racing car design and engineering
- Applying technical physics, computational thinking and engineering knowledge to the design process
- Testing and evaluating racing car performance
- Thinking creatively while adapting and amending designs
- Understanding autonomous technologies and the importance of accessibility in motorsports
- Using and understanding computer software



LESSON 1 (informative)

- What makes a winning racing car
- The importance of teamwork
- Different elements of a racing car and their relation to physics
- Introduction to PDC team
- Levels of vehicle automation
- Reflecting on skills learned

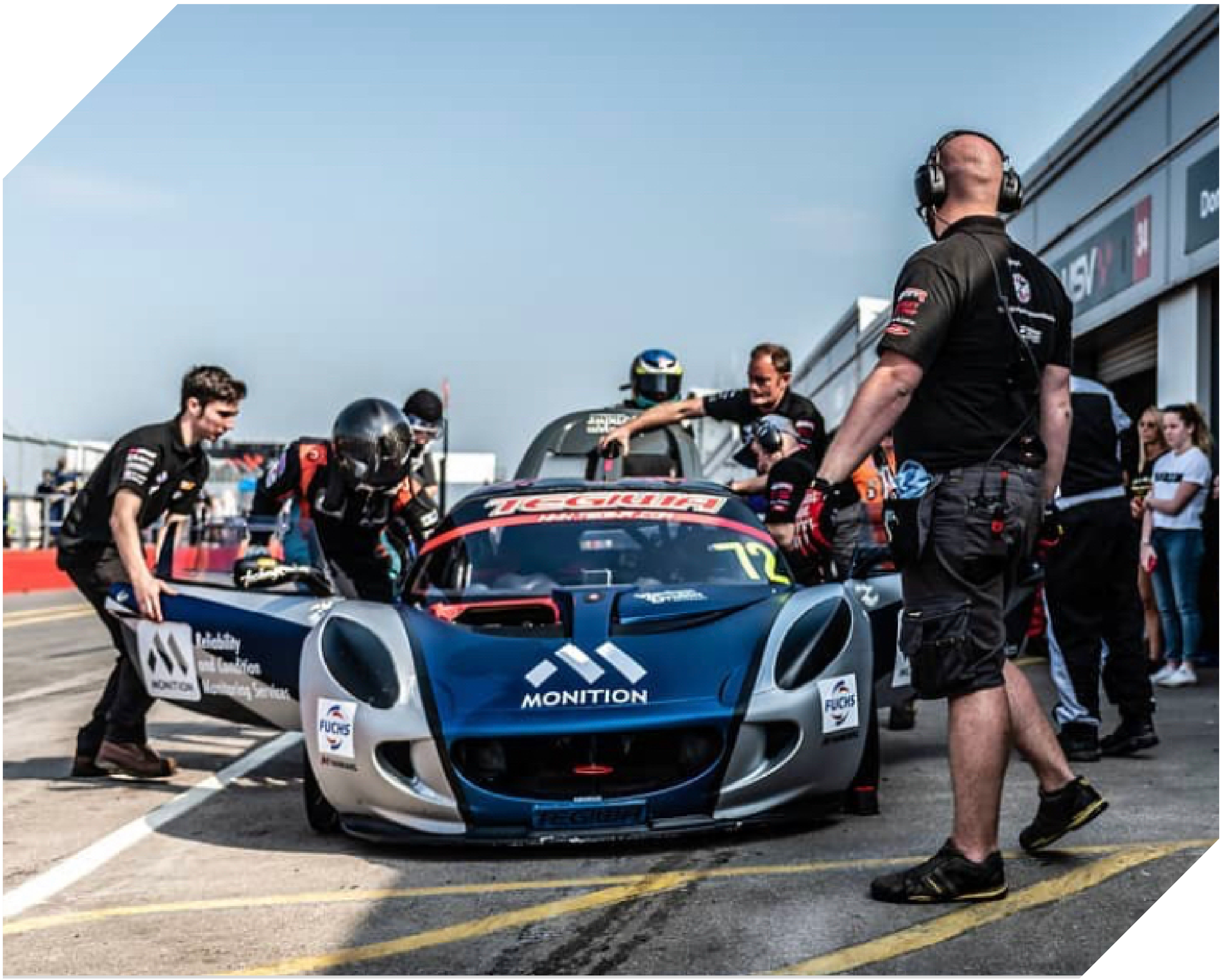
LESSON 2 (practical)

- Driver safety
- Introduction to variables
- Configuration of cars using software
- Analysing the effects of variables on the outcome of the race in teams
- Applying physics terminology to findings and acknowledging the correlation
- Adapting configurations to cost restrictions

DESIRED PUPIL OUTCOMES (lessons 1 & 2)

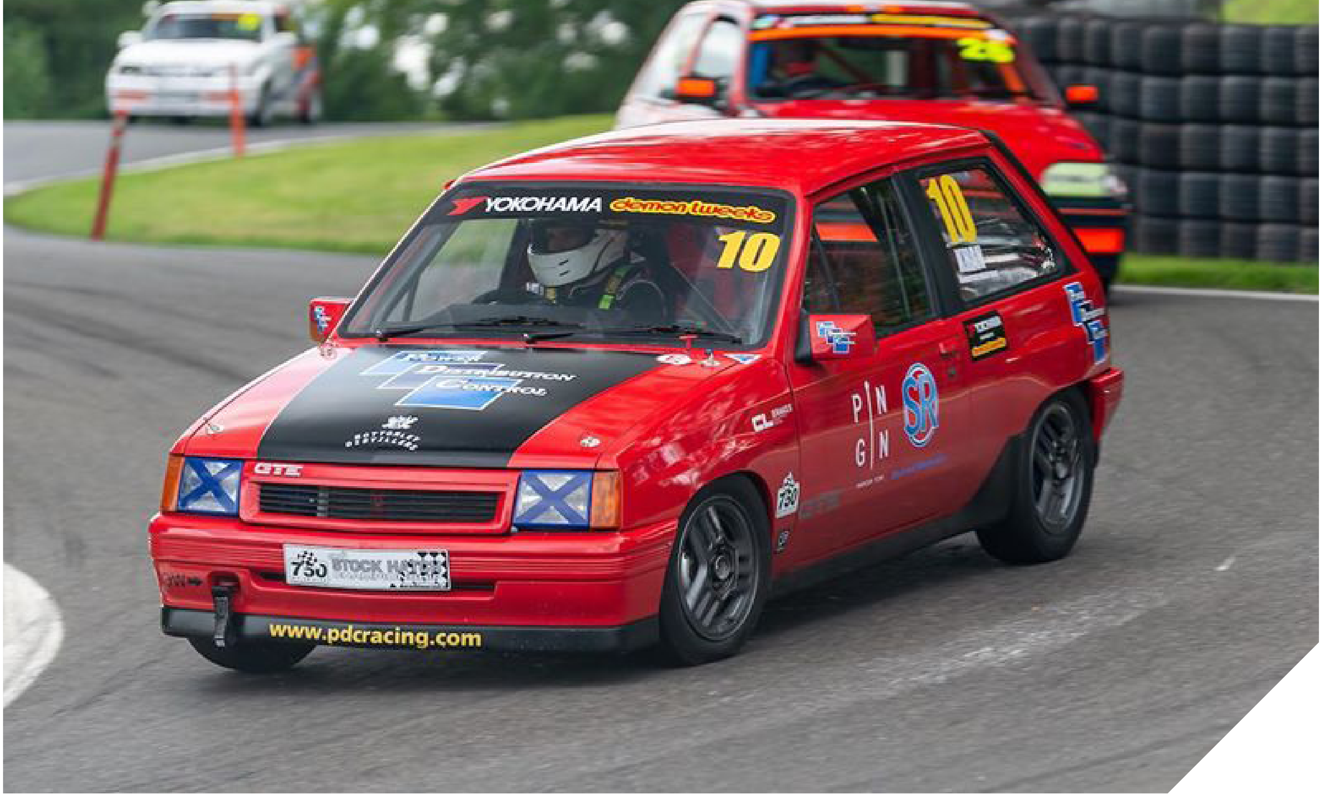
- I have gained knowledge on the scientific factors affecting motor racing
- I can explain what makes racing cars successful or unsuccessful
- I know the role driving conditions can play when driving a vehicle
- I have developed skills to analyse, measure and optimise scientific factors to make the racing car perform better
- I can evaluate the work of my peers and give helpful, scientific feedback
- I can work as part of a team to a shared goal
- I know how to test my ideas in a virtual setting
- I can explain the different types of driverless cars and driverless technology

Overview



The combination of outstanding teamwork and brilliant engineering create a winning motorsport racing team. Science is used to create new technologies that can be engineered into the racing car in order to analyse and improve performance with mathematical precision (STEM), resulting in the team being placed on the winning podium.

This lesson looks into the fundamental principles of physics that keeps a racing car at the top of the leader board and the importance of teamwork between designers, engineers, pit crew and the driver needed to keep it at the top.



Lesson 1

REMEMBER...

While this lesson plan has been timed to run over two lessons, it can also be spread out over a longer time frame. For lower or mixed ability classes, we advise extending lesson 1 over two sessions in order to a) grasp the scientific concepts and b) fully understand the worksheet ask, before moving on to lesson 2.

LESSON STRUCTURE:

1. **Types of motorsports** — **Slides 5-14**
   a. Surfaces
   b. Conditions
2. **Cars** — **Slides 15-25**
3. **Team** — **Slides 26-57**
4. **Design** — **Slides 58-67**
5. **Reflection** — **Slides 68-70**
6. **Homework** — **Slide 71**
7. **Stretch & Challenge** — **Slides 73-83**
   a. Autonomous vehicles
   b. Situational awareness

1. Intro activity – PPT led – 20 minutes

SHOW (slide 3)

- The PDC video introducing the racing challenge

ASK (slides 5-7)

- What are the different types of motorsport?
- What type of surfaces do they race on?
- What type of weather conditions can they race in?

ACTIVITY

Give each table one of the printouts detailing a motorsport category. Have one person go to another table and collect information about that racing type to fill out their **Motorsports Cheat Sheet.**

EXPLAIN (slides 8-12)

The characteristics of each motorsport category, using the images on the slides:

- F1 – Tarmac – Dry and light rain
- Rally – Tarmac/ gravel/ rough road/ grass – All weathers
- Rally raid – Rough road/ no road/ deep mud/ deep water/ steep inclines – All weathers
- Go-karting – Tarmac – Dry and light rain
- Drag racing – Tarmac – Dry only

ASK (slides 13-14)

- What do we need to consider in regard to driving conditions?

REVIEW POINT

ASK

- What can students relay back to you about motorsports so far?
- What events and complications can arise on the track in motorsports?

IMAGINE

2. EXPLAIN (Slides 15-21)

Use the slides to go through the key factors students need to consider with their racing car design:

- Tyre choice – Width and shape
- Engine choice – Power, top speed, mass and fuel efficiency
- Vehicle body features – Drag, down force and crash survivability
- Suspension choice – Spring stiffness and centre of gravity
- Overall mass – Fuel efficiency, acceleration and cornering
- Driving conditions – Surface type and weather conditions

DISCUSS (slides 22-24)

The elements that affect how the racing car stays on the track, how the car gets to the lead position, utilises fuel consumption and stays safe in a crash:

- Grip – Ability to stay on the track in dry, wet or rough conditions
- Acceleration – Ability to get away from the start quickly and get past other racing cars
- Weight – Altering the weight of the vehicle will drastically affect the speed and control of the car; too light and the driver will struggle to control it, too heavy and the finish time and fuel usage could drastically increase
- Aerodynamics – To move through the air with the least amount of resistance and generate force to help stay on the track
- Safety features – Roll cage to protect the driver from crushing, harness and belts to hold the driver in position, crash helmets and neck braces to look after the head, crushable parts of the racing car to absorb impact etc.

Use the details on the slides to connect the topic of science to staying on the track, leading the race, having enough fuel and staying safe:

- Friction – Contact between the tyre and the surface; air resistance (drag) between the racing car body shape and the air it is moving through
- Power – Rate at which the chemical energy stored in the fuel can be transferred to the engine to create kinetic energy that moves the car forward
- Mass – Gravity's effect on the weight of the car; this impacts the rate of acceleration, but also holds the car to the track when cornering
- Material composition and design - Materials play a key part in the efficiency of a car's performance; material scientists design the most cutting-edge materials and processing techniques to support this sport.

  For example:

  - Carbon fibre is light but strong and is great for aerodynamics (hence why it is used on the car and the helmet)
  - Iron based alloys are very strong and are used to make the crankshaft and camshafts
  - Magnesium alloys are required by the FIA to be used in wheels

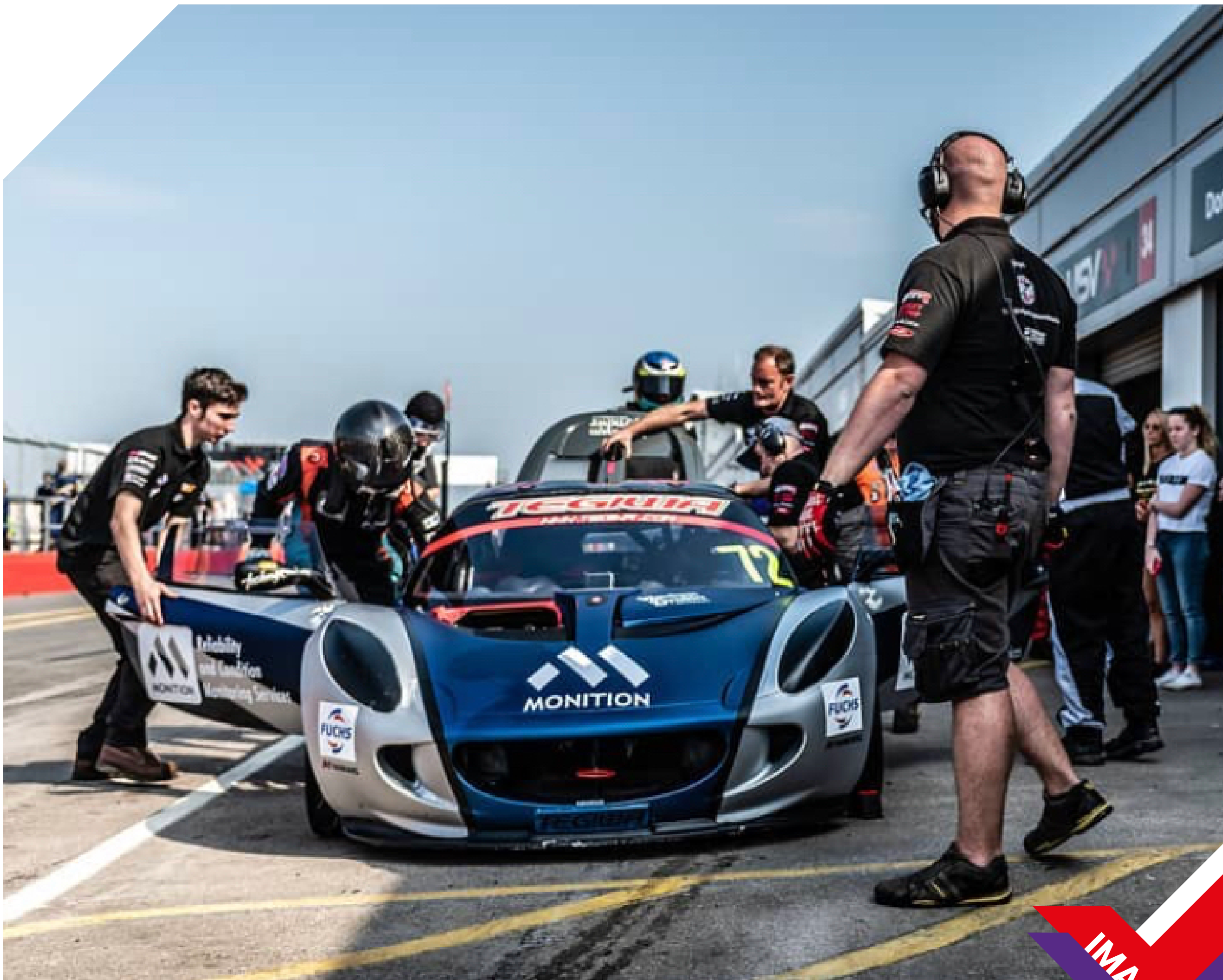
ACTIVITY

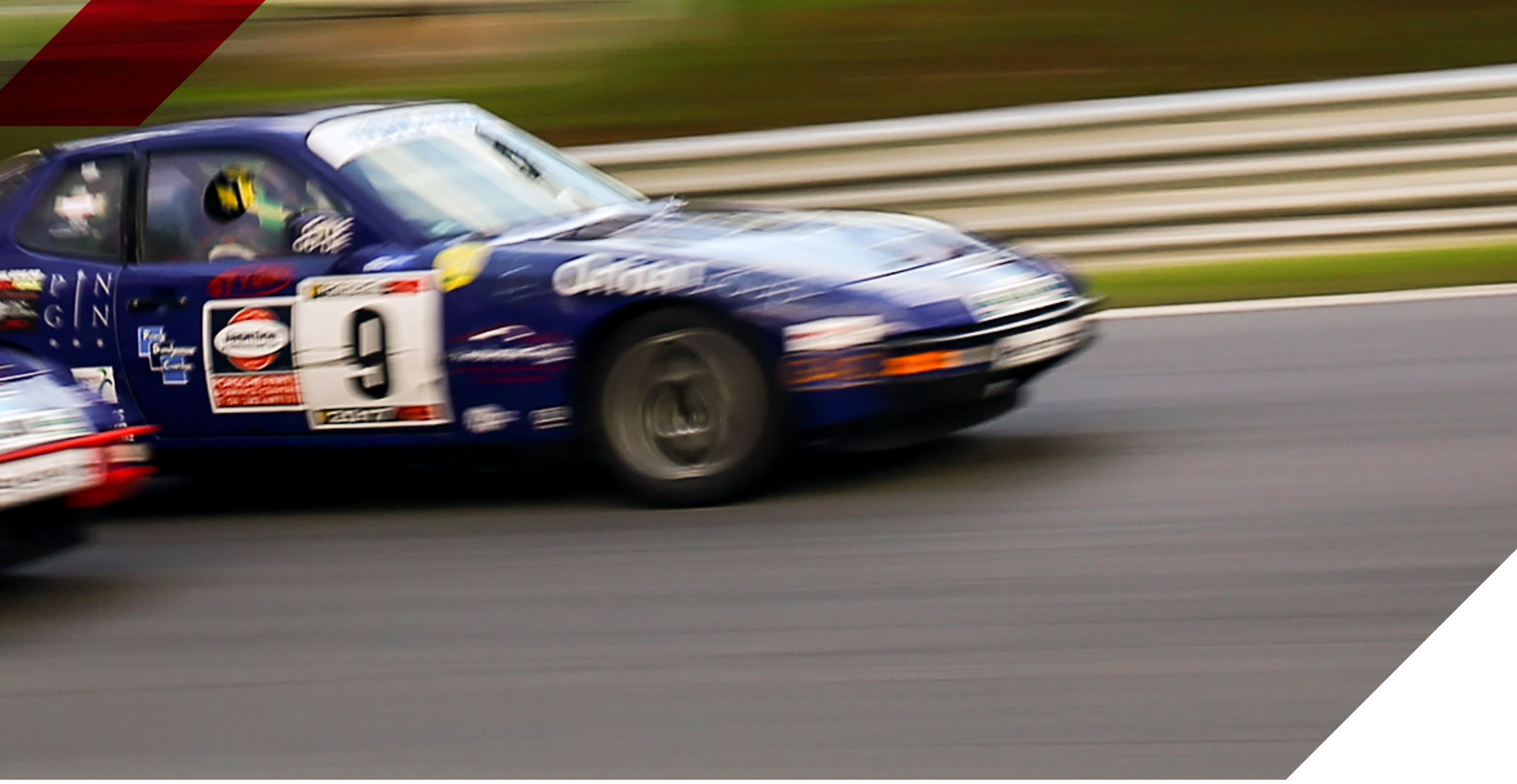
Cut up the **Crib Sheet** and give each table one of the factors that affects the performance of the race car. Have one person go to another table and collect information about that attribute to fill out their **Motorsports Cheat Sheet**.

REVIEW POINT

ASK (slide 25)

- What impacts a vehicle's performance?





Main activity – 40 minutes (slides 26-66)

3. ASK (slides 26-36)

What makes a successful race winner in motorsports?

- Is it the driver?
- Is it the racing car?
- Is it lots of money?
- Is it just being the fastest?
- Is it reliability?

Before going through the following slides, ask students for their opinions on this first and get them to write down and discuss their answers with others.

ACTIVITY

Give each table one of the printouts detailing an attribute to a successful race winner in motorsports. Have one person go to another table and collect information about that attribute to fill out their **Key Features of Success** worksheet.

INTRODUCE (slides 37-43)

- The three PDC team members and their roles within the team

EXPLAIN (slides 44-50)

The roles that students can take in their race team and what each role might need to do:

- Engineer
- Software engineer
- Electronics expert
- Marshals
- Pit crew

ACTIVITY

Give each table one of the printouts detailing one of the key roles in motorsports. Have one person go to another table and collect information about that role to fill out their **Motorsports Cheat Sheet.**

Have students get into their desired groups of <5 and pick their roles within the team

EXPLAIN (slides 51-54)

- The Hamilton Commission and their aim to identify the key barriers to recruitment and progression of Black people in UK motorsport and provide actionable recommendations to overcome them using slide 53 as guidance
- The importance of inclusivity in motorsports and how scientific progression has meant that those with disabilities are able to drive thanks to specialised features incorporated in racing cars

SHOW (slide 55)

- The video of Nathalie McGloin

EXPLAIN (slide 56)

- How her car has been adapted to her disability so that she can still drive the car safely and comfortably

ASK (slides 56-57)

- How does Nathalie utilise her senses to understand the car's performance?
- Can students think of ways that they could make their car more accessible?

4. SHOW (slides 58-65)

- The features of the game that they will be using to race their cars in the lesson and take them through the different options they can choose from when customising their vehicle

Option 1:
Teacher chooses the track type that the students will design their racing cars for

Option 2:
Class votes quickly for which track type to design their racing cars for

REMIND (slides 66-67)

- Students of the **Key Features of Physics** supporting worksheet and the worksheets they have already filled out which they can refer back to when designing their racing car. Split them into teams of less than five and provide each team with their **Design Team** worksheet that needs to be completed

Have teams begin their design process; it is suggested to keep on walking around each team to ensure they don't spend too much time focusing on unnecessary details or rush through without thinking about the impact of their decisions

5. Plenary – 10 minutes (Slides 68-70)

ASK

- Each group to briefly explain their choices of racing car configuration and comment on the skills they used to ensure their team worked well together
- Students to think back to the slides on Nathalie McGloin and how they could alter their designs so that they are accessible to those with disabilities

Collect in the Design Team worksheets for lesson 2

SUMMARISE

- The driving conditions, key factors that affect vehicle configuration and the importance of teamwork in enabling success

6. Stretch & challenge homework (slide 71)

Provide the students with the Homework worksheet which asks each team to consider how the mechanics need to work as a safe and efficient team for a pit stop:

- What roles do they need to perform in the pit stop?
- What order do activities need to occur during the pit stop?
- What makes a quick pit stop?
- What makes a successful pit stop?

BONUS QUESTION: What role would you pick in the pit stop and why?

7. Stretch & challenge - recommended 30 minutes (slides 73-83)

In 2004, the USA's military research team DARPA started the Grand Challenge for autonomous vehicles to cover 132 miles of rough desert terrain that laid the foundations for the latest autonomous vehicle technologies being investigated.

EXPLAIN
- The five key levels of autonomous vehicles using the slide material

ASK
- The students to think about how these levels might be applied or modified to what a human does while walking around a school room

DISCUSS
- The impact of how autonomous vehicles might change motorsports and what elements of this would pique people's interest in the sport if it were to be autonomous (i.e. robot racing)

EXPLAIN
- Situational awareness using the slides to guide you

ASK
- What elements of a racing car can help with situational awareness? (i.e. mirrors, sensors, pit crew reporting via headset etc.)

EXPLAIN
- How autonomous vehicles could change the future of motorsports

ASK
- How do students use situational awareness in everyday situations (i.e. crossing the road, going to their next classroom, how they will create their cars etc.)

EXPLAIN
- How autonomous vehicles could change the future of motorsports

ASK
- Whether the removal of the driver from the sport is fair?
- Would they still watch the sport?
- Would the sport still be fun to watch?
- Is speed the only thing that makes motorsports exciting?
- What elements of autonomous vehicles could be capitalised upon to improve motorsports while still including the driver?

Lesson 2

REMEMBER...

This lesson will rely heavily on the accompanying virtual game. You will need access to a computer in order to play it.

LESSON STRUCTURE:

1. Lesson 1 recap	Slides 85-89
2. Variables	Slides 90-102
3. Practical	Slides 103-105
4. Amends	Slides 106-114
5. Reflection	Slide 115
6. Stretch & challenge	Slides 116-118

1. Intro activity - 15 minutes (slides 85-89)

Use the slide material to recap on the previous lesson:

- To win in motorsports it's a team event; if you have used the stretch & challenge homework option, now is the time to ask the class what their findings were
- How key factors of vehicle design link to key features of physics

2. EXPLAIN (slides 90-102)

- How the driver is kept safe inside the car
- The three types of variables, using the slide material to guide you, and how they are important to the design process

Take the class through the example on the slides which details the difference made to the finish time upon changing the vehicle mass in two scenarios on the same circuit (see teachers notes for the answers to the case study question).

EXPLAIN

- How to look for performance trends when altering the vehicle design
- How to identify what elements give the largest time increase/ decrease when changes are made to the independent variable through the use of a test plan

3. SHOW (slides 103-105)

- The students how to get access to the software they will be using to configure and test their racing cars on
- Remind them to select the track type that was chosen for their teams in lesson 1
- Make sure they understand that they have a limited time to carry out their track testing, just like in a real race

4. Main activity – 40 minutes (slides 106-114)

Have students begin making, testing and racing their designs using the software.

ASK

- What key feature made the most difference to each team's finishing time?
- How does that change link back to the key physics terminology?
- What is the worst thing that could happen during the race in relation to the fuel usage?

EXPLAIN

- The different types of fuel used in motorsports and how fuel is strategised to ensure the car can make the entire race with little or no need for refuelling, using the slides as a guide

DISCUSS

- The case study on slide 103 detailing how PDC strategised their fuel usage during the 2019 Spa-Franchorchamps

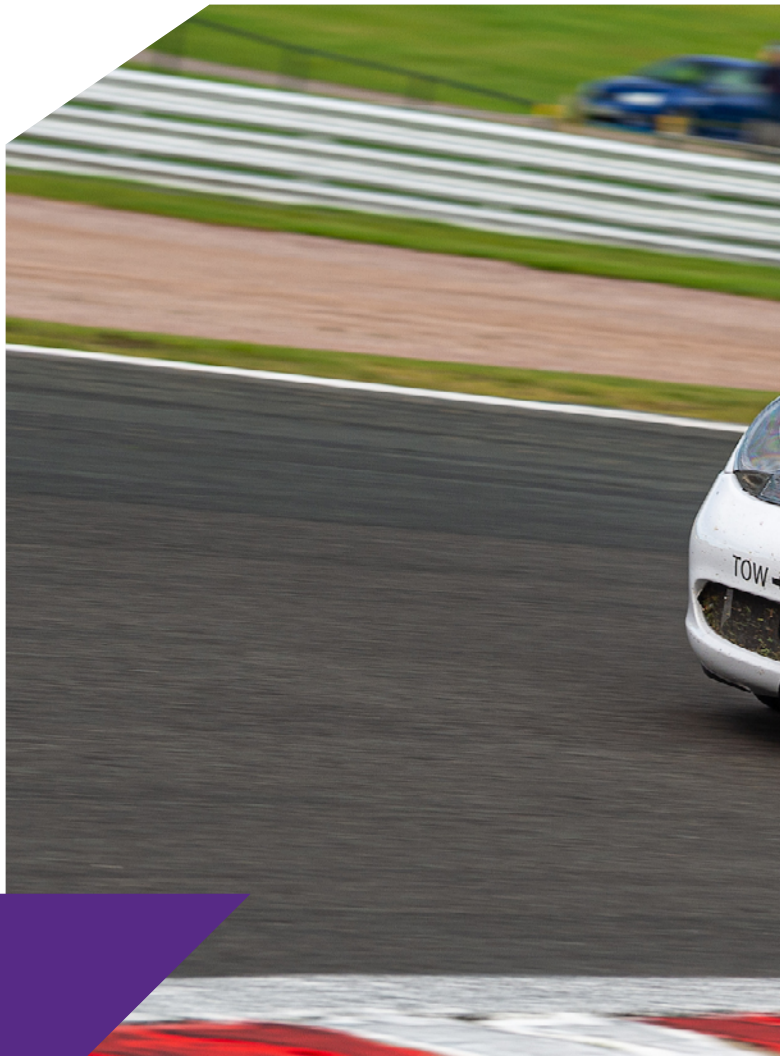
Optional: EXPLAIN

- There is one additional influence on the leader board scores: how much fuel each car has used will also be a key factor in deciding the winner

Have each team make sure they have their final race configuration and run the race on the decided track to get their final finish time (and fuel usage); write the team results down on the board (each litre of fuel adds 0.5 seconds to their team finish time)

Stretch & challenge

- Provide the teams with the **Cost of Value** worksheet and set a budget they have to be equal to or under. The recommended budget is between **£30,000** to **£80,000** depending on how difficult you wish to make it for students to adhere to their budget; alternatively, this budget can be increased to **£100,000** to make the task easier for students to undertake
- Have the teams calculate the cost of their final race configuration and adjust the configuration to meet the budget restrictions



Plenary – 10 minutes (slide 115)

ASK

- The top three teams to explain their final race configuration and the thought process behind their amends
- Students to think about how they have used different elements of STEM when designing and amending their cars

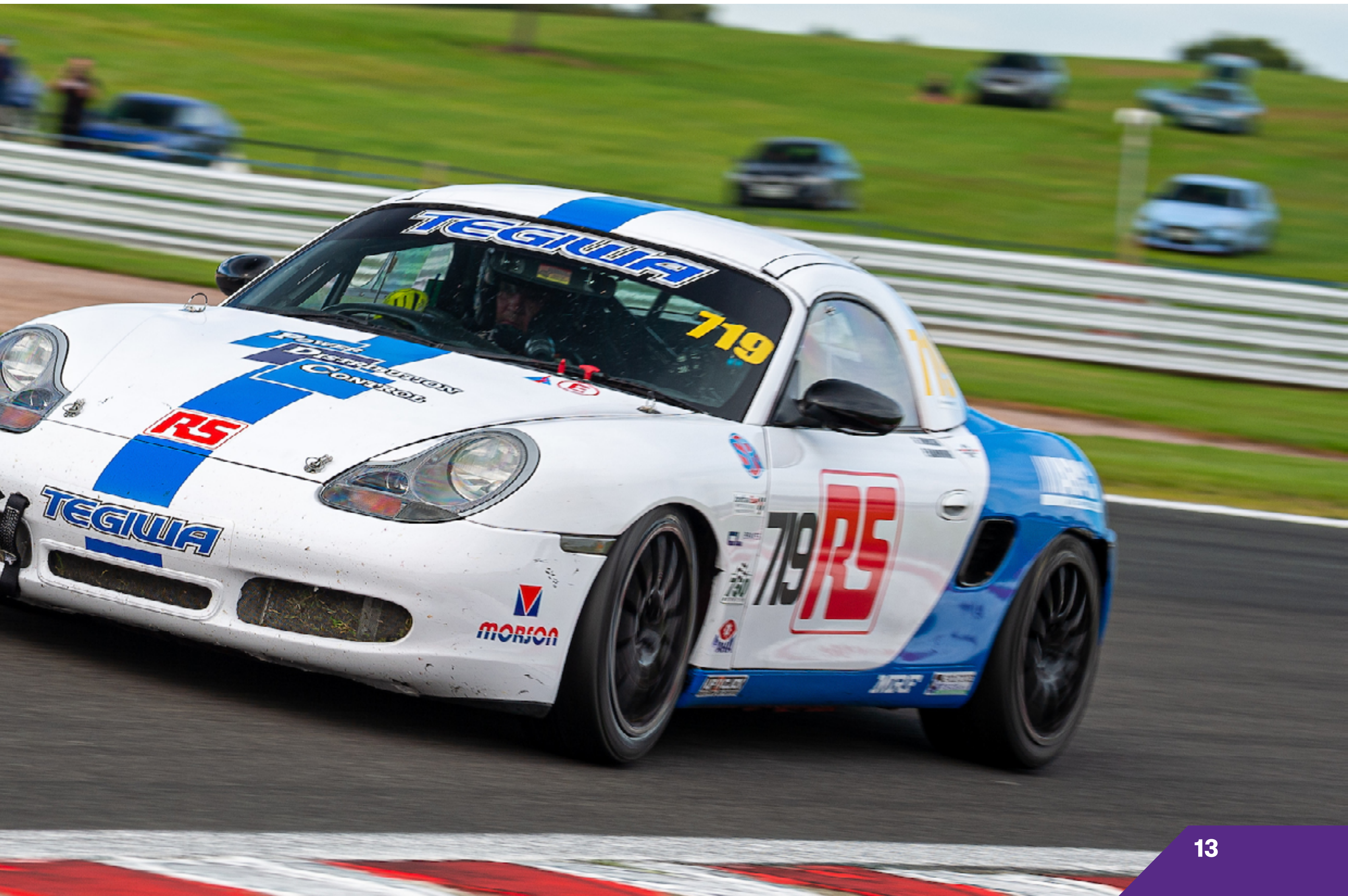
Optional: Decide if you wish to hand out prizes for 1st, 2nd and 3rd place.

Stretch & challenge (slides 116-118)

Point out the virtual prize money on the **Cost of Value** worksheet for the 1st, 2nd and 3rd place teams to calculate whether they have made a profit.

DISCUSS

- The impact motorsports has on normal cars
- How forcing motorsports to be fuel efficient helps normal cars that we purchase



Teaching notes

Key science principles

Power = energy/ time	The more energy the engine can output in a short space of time, the larger the force the engine can apply to the tyre contact area.
Work done (energy) = force x distance	Energy from the power equation and the distance the wheel turns through allows force to be calculated.
Force = mass x acceleration	The speed at which your vehicle can move forward depends on its mass and the force that the engine can put out. The lower the vehicle mass, the higher the acceleration from the force.
Weight = mass x gravitational field strength	However, a low mass doesn't help you go around corners fast because the vehicle weight isn't enough to generate the downward pressure, which in turn generates friction to stop you sliding off the track.
Pressure = force/ area	The bigger the tyre contact area, the more force you can put into pushing the car forward without spinning the wheels or sticking to the road to go around a corner. But the bigger the tyre contact area, the larger the rolling friction which slows the vehicle down.
Force = spring constant x extension	A soft spring allows for lots of movement to keep the shocks from the road from damaging the vehicle on rough roads but makes the vehicle more difficult to drive fast. A stiff spring allows for very little movement and allows the vehicle to drive fast and change direction rapidly.
Front-facing surface area and smoothness	Small, forward-facing surface area and smooth surfaces reduce drag to go fast but doesn't generate much down force to help increase contact pressure at the tyre contact area when going around corners. Adding aerofoils to generate downward thrust increases drag which slows the car down. This means a low mass vehicle can accelerate quickly but generate enough downward force to go around a corner fast.
Force = mass x velocity/ impact time	If you can lengthen the impact time during a crash, you reduce the force a driver will experience. So a race car reduces its mass by falling apart in a crash and has materials that have a soft spring constant to increase the impact time. The roll cage is made of materials with a very high spring constant to create a safety area which the driver doesn't get squashed inside of.

Teaching notes

Word bank:

Car modification
The definition of a car modification is a change made to a vehicle so that it differs from the manufacturer's original factory specification (Burrows Motor Company).

Road-legal car
A road-legal car is a vehicle which meets the legal requirements to be driven on roads. Features that make a car illegal on regular roads include:

- Neon light fittings
- Overly-tinted windows
- Engine modifications such as removal of catalytic converter

Information on what makes a car road-legal can be found here: https://www.hg.org/legal-articles/what-makes-for-a-street-legalvehicle-31563

G-Force
The force of gravity, also known as a unit of acceleration.

Water displacement
In wet conditions a grooved tyre is used. The grooves allow the tyre to quickly displace the water into the grooves. This ensures as much rubber as possible is in contact with the ground and ensures there is grip. An F1 tyre can disperse up to 60 litres of water per second.

Lesson delivery and timings:

This plan should serve as a guide but can easily be adapted to suit your teaching schedule by expanding or cutting short whichever sections you feel appropriate. You don't need to include every aspect of this plan and presentation if it is not beneficial to your students.

We recommend group activities are limited to a maximum of 15 minutes. Focus should remain on content learning in lesson one while more practical learning is the focus of lesson two.

Progress and assessment:

Measure progress by asking your class to reflect on content and explain what they've learnt. This is prompted throughout each lesson with suggested questions in the presentation and further suggested activities which encourage students to put their new knowledge into practice. You should also encourage students to use the test table method detailed in the presentation to assess their own work and reflect on the outcomes.

Variable question:

The variables in the case study in lesson 2 are as follows:

Independent variable - New weight rule to qualify for race

Dependant variable - Vehicle features

Controllable variable - Vehicle mass

Teaching notes

Imagine-X Racing: Game questions

Below is a list of the questions and their respective answers that are listed within the Imagine-X Racing game. They can be used in the practical version of the main activity at the start of the race to determine the placement of each car, and during the pit stop to ensure that students have understood the lesson content. They must correctly answer the questions as fast as possible to continue with the race.

The correct answer for each question is in **bold**.

How many tyres did Lewis Hamilton have when he crossed the 2020 British Grand Prix finish line?

- 1
- 4
- **3**

What is the name of one of the most famous Rally Raid events?

- Meteor Rally
- **Dakar Rally**
- Rodeo Rally

Which car has to deal with the roughest surfaces?

- Formula 1
- **Rally**
- Go-kart

How many teams usually take part in Formula 1?

- 18
- 25
- **20**

If a vehicles mass is high, which of the following is true?

- **It is harder to slow down**
- It is easier to slow down
- Mass doesn't affect braking

How does Nathalie McGloin understand the performance of her car on the track:

- **Nathalie utilises the vibrations from the car and looks at the car's gauges**
- If another car passes her Nathalie knows performance is dropping
- Nathalie knows that performance is ok because it was last time

Which of these features are usually implemented into a racing car to keep the driver safe? (TRICK QUESTION)

- **The use of the correct tyres for the track conditions**
- **Specialised seatbelts**
- **Safety cage and structure**

If your car design results in a large amount of drag, how does this affect the overall performance?

- **Slower on straights**
- Faster on straights
- No difference

Which of the following is the suspension system used for a go-kart?

- Flosser and brassis
- **Flex and chassis**
- They don't need one because of their low centre of gravity

What do partially automated vehicles do?

- **Use data for cruise control**
- Drive without human interaction in certain areas
- Use parking sensors and cameras

What animal weighs more than the average rally car?

- **Black rhino**
- Sheep
- Panda

Bonus Q (hard q's)

Why did the designer of the Tyrell P34 believe six tyres would be more beneficial than four?

- **It would better tackle the air resistance**
- It would increase the mass and thus be safer to drive
- It would increase grip for wet weather conditions

What are iron-based alloys used for in vehicle design?

- Helmet and seatbelts
- Spoilers
- **Crankshaft and camshafts**

Pit stop q's:

Who set the record for the quickest time taken to complete an F1 pit stop in 2019?

- Mercedes Benz
- Toyota
- **Red Bull**

What was the quickest time taken to complete an F1 pit stop in 2019?

- **1.8 seconds**
- 3.7 seconds
- 2.4 seconds

What was the average time taken to complete an F1 pit stop in 2019?

- 1.8 seconds
- 3.7 seconds
- **2.4 seconds**

In which motorsport has refuelling mid-race been banned?

- Drag racing
- Go-karting
- **Formula 1**

Who lifts up an F1 car during a pit stop?

- **Pit Crew**
- Data Analyst
- Driver

If you have lots of downforce, your car will perform well at which part of the track?

- **Corners**
- Straights
- Pit Stops

What is the role of the pit marshal?

- Alert drivers to any issues on the track
- Fill up the driver's water bottle and check that they're ok mid-race
- **Ensure the safety of everyone and guide the traffic in the pit**

What is the most common engine used in Rally racing?

- 1.6 litre, double-overhead camshaft (DOHC) reciprocating engine
- **Turbocharged engine**
- 8-cylinder petrol engine

What was the difference in Pip Hammond's best time after modifying his car to meet the new weight rule implemented at the 2020 Porsche Championship?

- 7 seconds slower
- 1 second faster
- **4 seconds slower**

Curriculum links

KS3 – Years 7 to 9 – age 11 to 14

Science

Working scientifically

- Understanding that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- Evaluating risks
- Experimental skills and investigations
- Asking questions and developing a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- Making predictions using scientific knowledge and understanding

Energy

- Comparing amounts of energy transferred (J, kJ, kW hour)
- Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged

Motion and forces

- Speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)
- Forces as pushes or pulls, arising from the interaction between two objects
- Movement as the turning effect of a force
- Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water
- Forces measured in Newtons
- Force-extension linear relation; Hooke's Law as a special case
- Work done and energy changes on deformation
- Non-contact forces: gravity forces acting at a distance on Earth

Pressure

- Pressure measured by ratio of force over area – acting normal to any surface forces and motion
- Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)
- Change depending on direction of force and its size

Mathematics

Develop fluency

- Selecting and using appropriate calculation strategies to solve increasingly complex problems
- Making and testing conjectures about patterns and relationships; look for proofs or counter-examples

Solve problems

- Developing their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- Developing their use of formal mathematical knowledge to interpret and solve problems, including financial mathematics
- Selecting appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Computing

- Designing, using and evaluating computational abstractions that model the state and behaviour of real-world problems and physical systems
- Undertaking creative projects that involve selecting, using and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users

Design & technology

Design

- Using research and exploration, such as the study of different cultures, to identify and understand user needs
- Identifying and solving their own design problems and understanding how to reformulate problems given to them
- Developing specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations
- Using a variety of approaches (for example, biomimicry and user-centred design), to generate creative ideas and avoid stereotypical responses
- Developing and communicating design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Evaluate

- Investigating new and emerging technologies
- Testing, evaluating and refining their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understanding developments in design and technology, its impact on individuals, society and the environment and the responsibilities of designers, engineers and technologists

Technical knowledge

- Understanding and using the properties of materials and the performance of structural elements to achieve functioning solutions
- Understanding how more advanced mechanical systems used in their products enable changes in movement and force
- Understanding how more advanced electrical and electronic systems can be powered and used in their products (for example, circuits with heat, light, sound and movement as inputs and outputs)
- Applying computing and using electronics to embed intelligence in products that respond to inputs (for example, sensors) and control outputs (for example, actuators), using programmable components (for example, microcontrollers)

IMAGINE

Curriculum links
KS3 – Years 7 to 9 – age 11 to 14

Science

Working scientifically

- Explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications and making decisions based on the evaluation of evidence and arguments
- Evaluating risks, both in practical science and the wider societal context, including perception of risk
- Recognising the importance of peer review of results, and of communication of results, to a range of audiences
- Analysis and evaluation
- Interpreting observations and other data, including identifying patterns and trends, making inferences and drawing conclusions
- Communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations

Concepts

- The concept of cause and effect in explaining such links as those between force and acceleration
- The phenomena of 'action at a distance' and the related concept of the field as the key to analysing gravitational effects
- That proportionality, for example, between weight and mass of an object or between force and extension in a spring, is an important aspect of many models in science
- Energy
- Power as the rate of transfer of energy

Forces

- Forces and fields: gravity
- Calculating work done as force x distance; elastic and inelastic stretching
- Pressure

Forces and motion

- Estimating speeds and accelerations in everyday contexts
- Interpreting quantitatively graphs of distance, time and speed
- Acceleration caused by forces; Newton's First Law
- Weight and gravitational field strength
- Decelerations and braking distances involved on roads

Computing

- Develop their capability, creativity and knowledge in computer science, digital media and information technology
- Developing and applying their analytic, problem-solving, design and computational thinking skills

Mathematics

Solve problems

- Developing their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- Developing their use of formal mathematical knowledge to interpret and solve problems, including financial contexts
- Making and using connections between different parts of mathematics to solve problems
- Modelling situations mathematically and expressing the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- Selecting appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpreting their solution in the context of the given problem

Instructions for teachers

Lesson 1

Before you start

- Make the classroom ready to show a presentation (video and audio needed)
- Download the slides from the resource packs
- Set to the beginning slide 1 – Lesson 1
- Check access to the internet and specifically that the online activities are not blocked by any network security policies, so you can show the software and watch the YouTube videos

Resources

DRIVEN TO INSPIRE: THE SCIENCE OF GOING FAST! Presentation slides

- Teacher notes
- Screen and projector
- Worksheet: Design Team
- Information worksheet:
  Key Features of Physics
- Homework worksheet: Pit stops
- Activity worksheets:
  Motorsports Cheat Sheet
  Key Features of Success
  Crib Sheet
- Coinciding printouts

Lesson 2

Before you start

- Set to the beginning slide 84 – Lesson 2
- Check access to the internet and specifically that the online activities are not blocked by any network security policies, so students can access the software
- Ensure computers or tablets that can operate the software are available for students to use

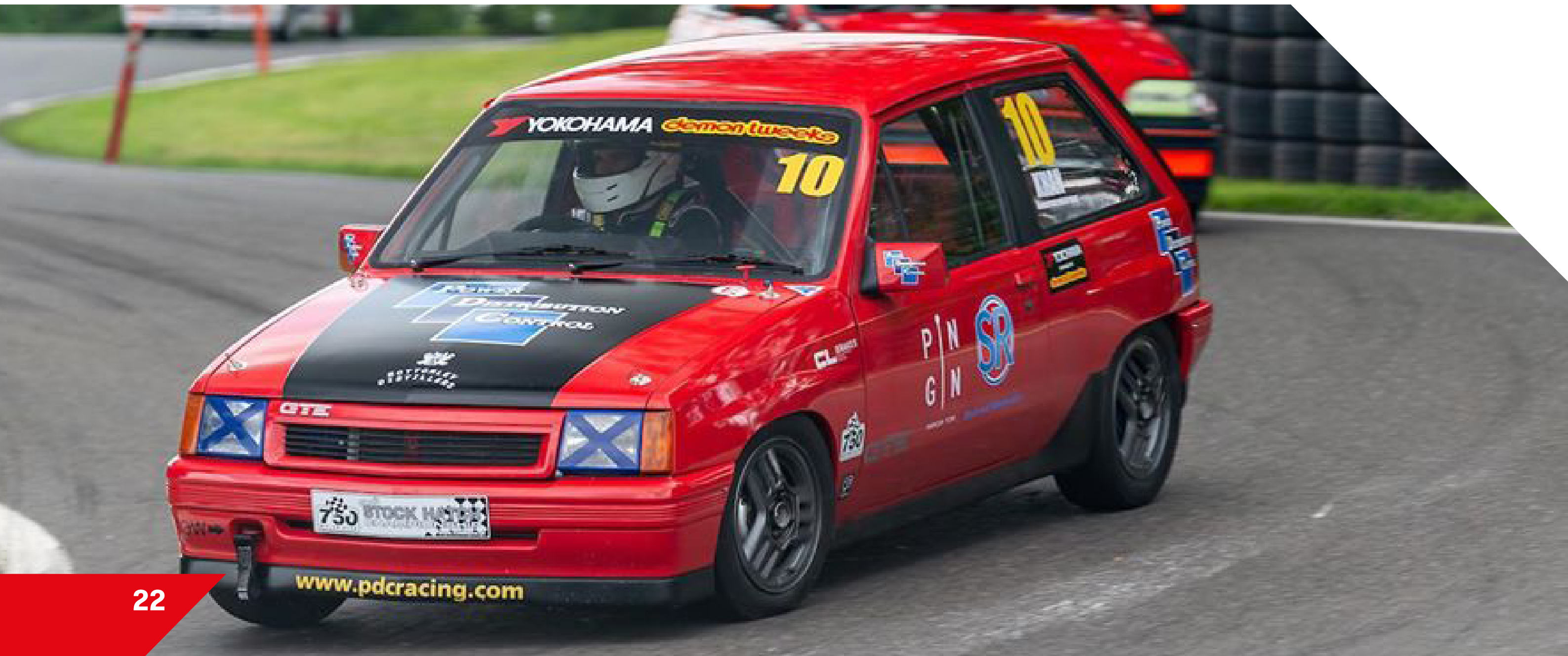
Resources

DRIVEN TO INSPIRE: THE SCIENCE OF GOING FAST! Presentation slides

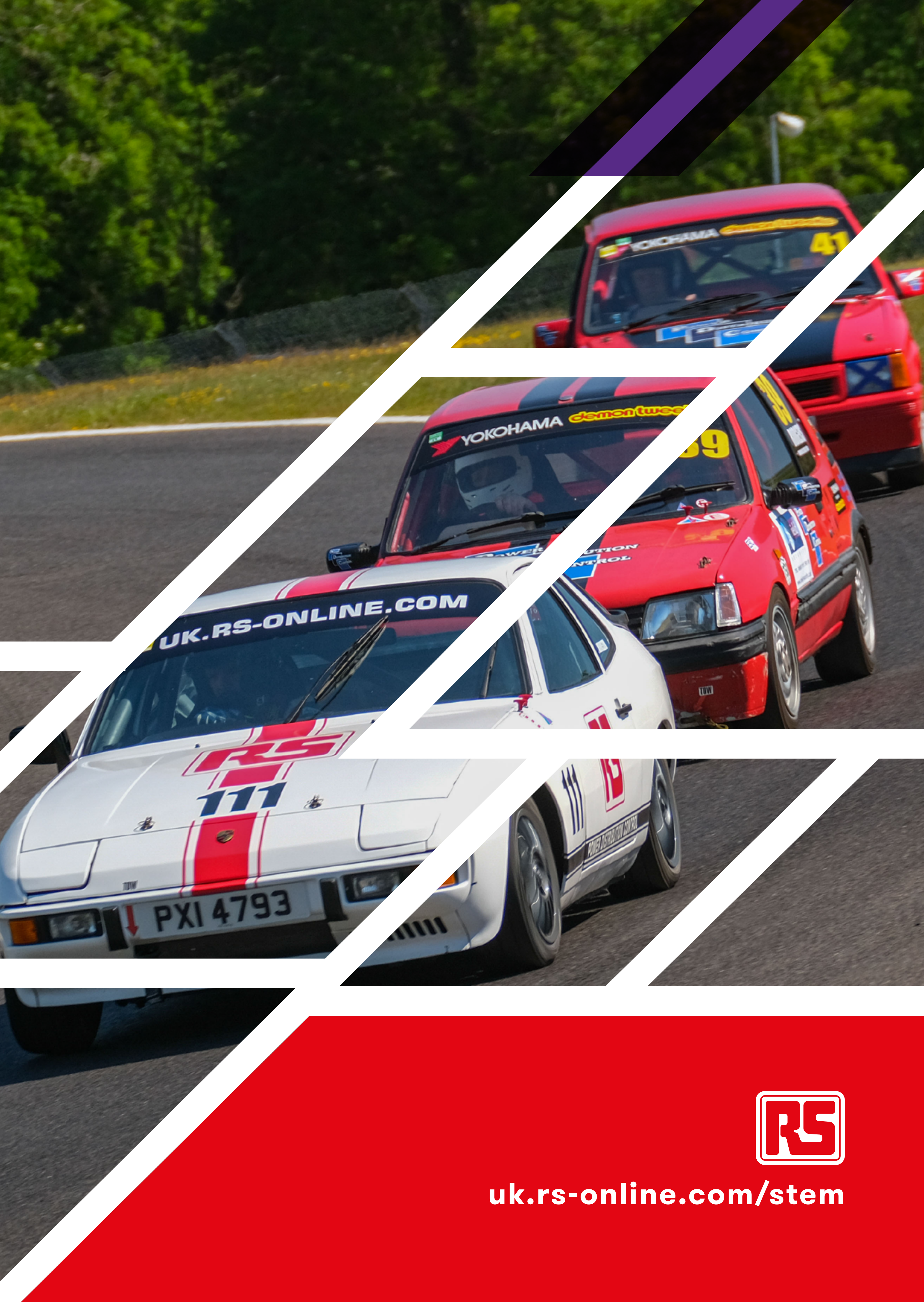
- Teacher notes
- Screen and projector
- Worksheet: Design Team - from lesson 1
- Information worksheet: Cost of Value
- Activity worksheet:
  Motorsports Cheat Sheet
  - from lesson 1

Safety and risk

Risk	Impact	Mitigation	Probability of occurrence
Transmission of disease.	Loss of student educational time.	Ensure to register all students (and staff) involved in the lessons for contact tracing and testing. Keep a list of which students are in each team.	Low to high, dependent on transmission rates within local area.
	Risk of serious health conditions for students and staff.	Clean all surfaces, equipment, keyboards and mice used by students during the lessons or leave equipment un-touched for 48 hours. Ensure current guidance is followed on social distancing.	Low to high, dependent on transmission rates within local area.



NOTES...



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