



Teacher Notes

Six for Six features 6 sets of complementary resources and/or activity suggestions aligned to curriculum requirements for KS2, 3 and 4 STEM subjects using real-world examples of Siemens technology, engineering or manufacturing principles as basis for learning.

Teachers are invited to select one or more suites of Six for Six materials to be used at their own discretion over the course of a half-term or term.

Each set of six includes:

- Comprehensive teacher notes
 - Introducing and providing an overview of key learning objectives for the six resources and/or activity suggestions
 - Curriculum matrix including learning outcomes
 - Recommendations for when and how to use the resources
 - Links to additional learning opportunities and events associated with the STEM learning framework and calendar
- Six, curated lesson plans, films, interactive learning tools, workshop or challenge event activity suggestions each linked to the other to repeat and reinforce learning opportunities

Download here

Module 1: Understanding the body and how it works – using and interpreting images to understand systems such as digestion and skeletal in the human body.

Module 2: Living in a world made by STEM – looking at the changes made to the world around us by developments in science and technology.

Module 3: Energy for thrills – seeing how the concept of energy transfer can help us make sense of everything from rollercoasters to double deck buses.

Module 4: Power to the people – the quality of our lives depends upon a reliable and cheap supply of energy. This needs to be achieved without damaging the environment however.

Module 5: Getting around – transport systems are crucial to modern life but need careful planning and operation to be fit for purpose. Thought needs to be given to the technology used, organisation and energy sources.

Module 6: Building the things we need – manufacturing skills are crucial to providing the products we need but they also provide jobs and develop skills. Manufacturing uses scientific ideas, logical thinking and an understanding of the wider world.

Module 5: Getting around

Introduction

We are surrounded by things that people have built; the quality of our life depends upon it. They may be bespoke items that are constructed to order or designed to be manufactured on a production line. Many modern houses are built in factories and shipped to the location to be assembled.

This area of work involves many people with a wide range of occupations and drawing upon a huge set of skills. Between them they understand concepts such as the properties of materials, they call upon skills such as sequencing and troubleshooting, and they know how to work effectively as a team.

A key aspect of understanding how systems work is the concept of feedback; whether this is monitoring by humans or, increasingly, how systems themselves can be designed and run to self-regulate. Sometimes the solutions developed involve the use of particular concepts and technologies; often these are applications of ideas from science.

Manufacturing and operating systems are required to function not only in a reliable and effective way but also to minimise any negative impact on the environment. Sustainability is now built into systems from the outset and is seen as a fundamental requirement.

Educational context/curriculum links

This module is designed to be run as a cross curricular activity, drawing together components of a number of STEM subjects as well as developing a broader agenda such as developing literacy and interpersonal skills. It could be used in a variety of ways including:

- A sequence of lessons delivered by one teacher but drawing upon a number of curriculum areas.
- A special 'STEM event', possibly using a STEM Ambassador to offer a different experience.
- A collapsed timetable session using teachers from different subject areas.

Subject references:

Maths

- Use existing mathematical knowledge to create solutions to unfamiliar problems.
- Understand that mathematics is used as a tool in a wide range of contexts.
- Identify the mathematical aspects of the situation or problem.

Science

- Recall, analyse, interpret, apply and question scientific information or ideas.
- Use both qualitative and quantitative approaches.
- Present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools.
- Describe the use of contemporary scientific and technological developments and their benefits, drawbacks and risks.

Technology

- Explore how products have been designed and made in the past, how they are currently designed and made, and how they may develop in the future.
- Make links between principles of good design, existing solutions and technological knowledge to develop innovative products and processes.



Overview of assets

Type of resource	Title of resource
Lesson plan and activity suggestions	Inspired Bus Company
Interactive learning tool	Self Driving Challenge
Digital Badge reward	On the Move Challenger
Lesson plan and activity suggestions	Green power challenge
Lesson plan and activity suggestions	Ringing true
Lesson plan and activity suggestions	A case to resolve
Links to careers and employment opportunities	Early Careers

Rationale

The key idea with the activities is to get students thinking about the challenges associated with organising transport. Depending upon the locality, many students will have first hand experience of issues relating to transport, whether in terms of convenience, cost or reliability. However, there are wider issues such as impact on the environment that need to be considered too.

Each of the resources uses transport as a theme and draws upon a range of skills from the STEM curriculum when challenging students to develop ideas and solutions.

1. Lesson plan: Inspired Bus Company

KS3 Science, Maths, Technology

In this lesson plan students are challenged to understand a range of the constraints effective upon a bus company. It starts off with the context of an urban bus route and refers to the range of customers whose needs are being met by this. It introduces aspects such as congestion and pollution. It then presents three different types of motive power and explains the pros and cons of each.



The materials then progress to talking about energy from braking. Some students will know from experiences with bikes or skateboards that heat is generated through friction; there is scope to use this to further reduce energy consumption. With a bit of resourcefulness, it should be possible to demonstrate this to focus discussion.

The next stage is to return to the fuel source and present the idea that this isn't an 'either/or' – an increasing number of vehicles are hybrids, using more than one type. Students are challenged to interpret data and suggest which might be useful. The final part involves students in drawing together their ideas to come up with a reasoned set of proposals for a fleet of vehicles to cover a variety of types of routes.

2. Interactive learning tool: Self Driving Challenge

Interactives

Another solution to the challenge of transport is that of self driving vehicles. This resource enables students, either in school or at home to take the challenge and, in so doing, to learn more about the way that such schemes are set up.





3. Digital Badge reward: On the Move Challenger

Digital badges

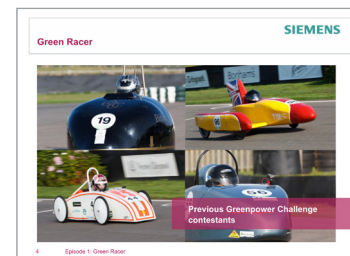
This digital badge is based on the use of the Inspired Bus Company resources (see above). The idea is that students would develop some ideas about hybrid vehicle technology and then present these. They should be able to identify pros and cons and to develop an overall, balanced and informed view in response to a particular situation.



4. Lesson plan: Greenpower challenge

Greenpower Challenge

This set of activities is centred around the concept of electric cars. This is an area that has been revolutionised in recent years; practice has moved from heavy and slow vehicles with very limited ranges to machines that can compete effectively with other fuel sources. The first part looks at the key components of an electric vehicle. It uses the Green Power Challenge as a context; if these materials are used in a school that participates in this competition then this can be utilised here. However if not the materials can still be used.



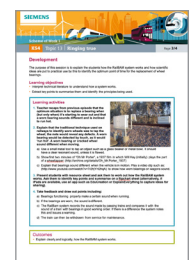
The second part of the materials looks at the design of the body of the vehicle. This is not approached from the point of view of aesthetics but rather as a key aspect of energy efficiency and therefore increasing performance, including range. The third part uses the context of a competition to encourage students to draw together ideas from different aspects.

5. Lesson plan: Ringing true

Ringing True

Another aspect of organising effective transport systems is maintenance. If machines are not kept in good working order they are likely to break down and cause operating problems but if they are taken out of service for maintenance it reduces their availability.

The materials refer to a particular example whereby a scientific principle is used to monitor trains and inform decisions about whether maintenance is required. The first part looks at the challenge of avoiding bearing failure, the second presents a possible solution in the form of monitoring sound and the final part requires the gathering together and presenting of ideas.



6. Lesson plan: A case to resolve

KS4 A Case to Resolve Scheme of work

This set of activities uses the context of a baggage handling system. Although not dealing with transporting people, such a system has to tackle a number of other problems such as how an automated system can read destination codes.

The first part explains the problem that needs to be solved and following components look at the testing of possible solutions, which involves some use of equipment. Finally, there is further challenge which is related to security screening as well as routing but again using scientific concepts – penetration of X rays as well as reflection of light.





Best teaching practice

There are various ways in which the resources can be used effectively but there are some key components that should be maintained.

Firstly, students need to be able to assimilate information, including that which is presented in unfamiliar ways. This is an important skill in a range of contexts and this set of activities offers a range of examples that can be used to develop these skills.

Secondly, working in STEM topics, students need to be able to use a range of scientific concepts, such as waves and energy, in order to understand contexts and develop solutions. This means drawing on or learning about ideas that may have originated in a different area of the curriculum.

Thirdly, students also need to be able to interpret and interrogate data. Information may be presented in a range of ways and it is important to be able to make sense of this and use it to support judgments that are being made.

Links to careers and employment opportunities

A key point with this whole resource is, of course, that some students may feel that the skills and practices are ones that may want to develop further; it is appropriate to have further information about skills, training and employment opportunities.

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Further reference

There are various additional resources that can be used to support these topics; the ones to be used need to reflect the particular topics being explored.

There are clips on YouTube that show hybrid buses being used and explaining how they work.

Self driving cars is an area of technology that is rapidly changing and developing with many examples being shared. Waymo is a pioneer and has shared videos of their technology in action.

There is a useful background summary from [Wired.com](#) at [The wired guide to self-driving cars](#)

Many schools involved in the GreenPower Challenge have shared materials on YouTube but there is a well made and informative introduction at: [Greenpower Inspiring future engineers](#) The project is explained at: www.greenpower.co.uk





For additional modules, visit www.siemens.co.uk/education

Suite No.		1	2	3	4	5	6
Phase		Primary	Primary	Secondary	Secondary	Secondary	Secondary
Focus		STEM	STEM	Science	Design Technology	STEM	STEM
Module:		1	2	3	4	5	6
Title		Understanding the body and how it works	Living in a world made by STEM	Energy for thrills	Power to the people	Getting around	Building the things we need
Asset #1	Lesson plan and activity suggestions	The human body - skeletal muscular system	Clean silent trains	Formula for thrills	E-zero Island	Inspired bus company	Keeping it lean and mean
Asset #2	Lesson plan and activity suggestions	The human body – digestive system	Bus activity sheet	Monte Rosa Mountain Hut	Interactive learning tool. Energy Island	Green power challenge	Totally in control
Asset #3	Interactive learning tool	Inside the Human Body	Life without STEM	Formula for thrills	Siemens Farm	Self driving challenge	Lean machines
Asset #4	Digital Badge reward	Curiosity	Technology	Rollercoaster challenge	Energy Challenger	On the move Challenger	Mechatronics Challenger
Asset #5	Lesson plan and activity suggestions	The human body – circulatory system	Words along wires	Here comes the Sun	Blowing in the Wind	Ringin' true	A case to resolve
Asset #6	Lesson plan and activity suggestions	More than skin deep	Let there be light	Blowing in the Wind	Underwater Energy	A case to resolve	Sustainability