

Curriculum Map of Primary Engineer – Apprentice Level 1 and 2 (Shoobox Car)

Please Note: Minimum requirement for Celebration Event – Pupils have completed the Pupils Workbook AND their shoobox car

- The Primary Engineer Mark Scheme is included at the end of this document for reference.
- Apprentice Level 1 = P1 pupils, Apprentice Level 2 = P2 and P3 pupils
- Engineering as a context for learning encourages pupils to develop key transferable skills through development of the Engineering habits of Mind - systems-thinking, adapting, problem finding, creative problem-solving, visualising, and improving. See [Learning to be an Engineer](#) - Implications for the education system By Royal Academy of Engineering (Summary Report published March 2017)

EHoM	Sub-habit 1	Sub-habit 2
CREATIVE PROBLEM-SOLVING is ... Generating ideas and solutions by applying techniques from different traditions, critiquing, giving and receiving feedback, seeing engineering as a 'team sport'.	Generating ideas: comes up with suggestions in a range of situations.	Working in team: has good people skills to enable idea and activity sharing; good at giving and receiving critique/feedback.
IMPROVING is ... Making things better by experimenting, designing, sketching, guessing, conjecturing, thought-experimenting, prototyping.	Experimenting: makes small tests or changes; sketching, drafting, guessing, prototyping.	Evaluating: making honest and accurate judgments about 'how it's going'; comfortable with words and numbers as descriptors of progress.
PROBLEM-FINDING is ... Deciding what the actual question is, finding out if solutions already exist by clarifying needs, checking existing solutions, investigating contexts, verifying, thinking strategically.	Checking and clarifying: questions apparent solutions methodically and reflectively.	Investigating: has a questioning, curious and, where appropriate, sceptical attitude.
ADAPTING is ... Making something designed for one purpose suitable for another purpose, by converting, modifying, transforming, adjusting, changing, reshaping, re-designing, testing, analysing, reflecting, rethinking.	Critical thinking: analyses ideas, activities and products; able to defend their own thoughts and ideas in discussion and also to change their mind in light of evidence.	Deliberate practising: disciplined; able to work at the hard parts.
VISUALISING is ... Seeing the end product, being able to move from abstract ideas to concrete, manipulating materials, and mentally rehearsing practical design solutions.	Thinking out loud: puts 3D ideas into words as they become pictures or rehearses possible lines of thought or action.	Model-making: moves between abstract and concrete, making models to capture ideas.
SYSTEMS-THINKING is ... Seeing connections between things, seeking out patterns, seeing whole systems and their parts and how they connect, recognising interdependencies, synthesising.	Connecting: looks for links, connections, relationships; working across boundaries.	Pattern-making: uses metaphors, formulae, images etc. to find patterns to illustrate new meaning.

Apprentice Level 1 – P1

Moray Skills Pathway - See Activity Overview Guidesheet for more details on Activities Pre/Post Engineer Visit

	Experiences & Outcomes/ Career Education Standards	Suggested Activities
What is an Engineer?	<p>CES - I can communicate with people about the different jobs they do in the community. Networks -1 E&O - I can describe some of the kinds of work that people do and I am finding out about the wider world of work. HWB 0-20a I explore a variety of products covering a range of engineering disciplines. TCH 0-12a</p>	<ol style="list-style-type: none"> 1. Complete the Pre-activity survey on STEM & Engineering 2. Draw an Engineer Activity – pupils draw an engineer and name their character (interesting to note proportion of males/female characters drawn and any safety clothing they might be wearing. This can be used to tease out misconceptions about this job and help you come up with ideas for questions for their engineer. 3. Identify the skills/attributes of an engineer – use labels to annotate their drawing: <ul style="list-style-type: none"> • Creativity – good at problem solving, imagination • Employability – good at making decisions, taking responsibility • Self-Management – confident and don't give up • Teamwork – good at working with others • Communication – listening and talking • Thinking – creating and applying knowledge • Interpersonal – respect others, resolve group issues • Leadership – encourage others, enthusiastic, contributes ideas 4. Engineering as a process – introduce the idea of Making 'things' that work and making 'things' work better (Core Engineering Mind). Examine examples of engineered products like bridges, towers, buildings, household objects (phones/TV etc) before moving on to cars as an engineered product.
Investigating Cars and Wheels Investigating Forces	<p>Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes. SCN 0-15a I explore a variety of products covering a range of engineering disciplines. TCH 0-12a E&O - Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects. SCN 0-07a</p>	<ol style="list-style-type: none"> 1. Timeline of cars through the ages – look at cars as an engineered product. How have they changed? (Key word – shape) 2. Examine different types of wheels – sort them into ones that help you go faster and ones that help you stick to the road. Look at wheels on F1 cars compared to an everyday car – how are they different? 3. What materials are the wheels made of and why? 4. Testing cars on a ramp – which ones go faster and why? Investigate: Try changing the materials on the ramp (carpet V tinfoil/smooth surface), adding a mass to the car, type/size of wheels, angle of slope, releasing car V pushing car.

Making the Basic Car	<p>CES - I can develop ideas and take part in projects to make things. Strengths-1</p> <p>E&O - I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others. MNU 0-11a</p> <p>I can share my thoughts with others to help develop ideas and solve problems.</p> <p>TCH 0-04c</p> <p>I explore ways to design and construct models. TCH 0-09a</p>	<p>Making the car involves</p> <ul style="list-style-type: none"> designing the vehicle – THEME could link to current IDL (there were some lovely tractors last time) VERY IMPORTANT: measuring the axles – can use non-standard measurements but key to car running straight is even axles Making the vehicle – they come with wooden wheels; old CDs make excellent super-fast wheels. Will you change the box shape to streamline it? Or add a spoiler?
Testing the Car 1 – Distance & Deviation Evaluation	<p>E&O - I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others. MNU 0-11a</p> <p>I can share my thoughts with others to help develop ideas and solve problems.</p> <p>TCH 0-04c</p> <p>I explore ways to design and construct models. TCH 0-09a</p>	<p>Testing the Car involves</p> <ul style="list-style-type: none"> You need a ramp to test the car and a smooth floor for the car to go onto You will want to measure how far it goes and how much it deviates from a straight line (at the celebration event they use tape or ribbon to mark a fan shape on the test zone) Why should you “release” car instead of “pushing” car? (refer back to forces lesson) <p>Evaluation involves</p> <ul style="list-style-type: none"> Which car went furthest/was straightest and why? How could you change your model to improve it?
Refining model Testing the Car 2	<p>CES - I can develop ideas and take part in projects to make things. Strengths-1</p> <p>I can share my thoughts with others to help develop ideas and solve problems.</p> <p>TCH 0-04c</p> <p>I explore ways to design and construct models. TCH 0-09a</p>	<ol style="list-style-type: none"> Make sure you spend time refining the model and retesting it. This process of tinkering with the design is key to the Engineering Habits of Mind (above). Discuss this with pupils – engineering is great for building resilience. If it does not work the first time, learn from it and try new things! Repeat testing and Evaluation process above till the car is ready!
Link Engineer Visit	<p>CES - I can communicate with people about the different jobs they do in the community. Networks -1</p> <p>E&O - I can describe some of the kinds of work that people do and I am finding out about the wider world of work. HWB 0-20a</p> <p>I explore a variety of products covering a range of engineering disciplines. TCH 0-12a</p>	<ol style="list-style-type: none"> Interview the engineer about their job – what do they do? How did they get into this job? What skills does it need? What school subjects did they do that help them in their job? What do they like best about their job?... Some schools scheduled their engineer visit at the start of the process and the engineer helped pupils make the basic car. Others asked the engineer to come in for the testing days to help them test, evaluate and refine their models.

Good Practice in Gathering Evidence – Some schools have used a specific floor book for the Engineering Project to gather pupils ideas/thoughts and pictures from the various activities. This was brought to the Celebration Event and really helped the judges when talking to the pupils to pick up on various aspects of what they had been doing.

Apprentice Level 2 – P2 and P3

Moray Skills Pathway - See Activity Overview Guidesheet for more details on Activities Pre/Post Engineer Visit

	Experiences & Outcomes/ Career Education Standards	Suggested Activities
What is an Engineer?	<p>CES - I can communicate with people about the different jobs they do in the community. Networks -1 E&O - I can describe some of the kinds of work that people do and I am finding out about the wider world of work. HWB 0-20a I explore and discover engineering disciplines and can create solutions. TCH 1-12a I can explore and experiment with sketching, manually or digitally, to represent ideas in different learning contexts. TCH 1-11a</p>	<ol style="list-style-type: none"> 1. Complete the Pre-activity survey on STEM & Engineering 2. Draw an Engineer Activity – pupils draw an engineer and name their character (interesting to note proportion of males/female characters drawn and any safety clothing they might be wearing. This can be used to tease out misconceptions about this job and help you come up with ideas for questions for their engineer. 3. Identify the skills/attributes of an engineer – use labels to annotate their drawing: <ul style="list-style-type: none"> • Creativity – good at problem solving, imagination • Employability – good at making decisions, taking responsibility • Self-Management – confident and don't give up • Teamwork – good at working with others • Communication – listening and talking • Thinking – creating and applying knowledge • Interpersonal – respect others, resolve group issues • Leadership – encourage others, enthusiastic, contributes ideas 4. Engineering as a process – introduce the idea of Making 'things' that work and making 'things' work better (Core Engineering Mind). Examine examples of engineered products like bridges, towers, buildings, household objects (phones/TV etc) before moving on to cars as an engineered product.

Investigating Wheels Investigating Forces	<p>Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges. SCN 1-15a</p> <p>I can recognise a variety of materials and suggest an appropriate material for a specific use TCH 1-10a</p> <p>I explore a variety of products covering a range of engineering disciplines. TCH 0-12a</p> <p>E&O - By investigating forces on toys and other objects, I can predict the effect on the shape or motion of objects. SCN 1-07a</p>	<ol style="list-style-type: none"> 1. Timeline of cars through the ages – look at cars as an engineered product. How have they changed? (Key word – streamlining) 2. Examine different types of wheels – sort them into ones that help you go faster and ones that help you stick to the road. Look at wheels on F1 cars compared to an everyday car – how are they different? 3. What materials are the wheels made of and why? 4. Testing cars on a ramp – which ones go faster and why? Investigate: Try changing the materials on the ramp (carpet V tinfoil/smooth surface), adding a mass to the car, type/size of wheels, angle of slope, releasing car V pushing car.
Making the Basic Car	<p>CES - I can develop ideas and take part in projects to make things. Strengths-1</p> <p>E&O - I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units. MNU 1-11a</p> <p>I can share my thoughts with others to help develop ideas and solve problems. TCH 0-04c</p> <p>I can adapt and improve my ideas and can express my thinking in different ways. TCH 1-04d</p> <p>I can explore and experiment with sketching, manually or digitally, to represent ideas in different learning contexts. TCH 1-11a</p> <p>I can design and construct models and explain my solutions. TCH 1-09a</p>	<p>Making the car involves</p> <ul style="list-style-type: none"> • designing the vehicle – THEME could link to current IDL (there were some lovely tractors last time) • VERY IMPORTANT: measuring the axles – can use non-standard measurements but key to car running straight is even axles <p>Making the vehicle – they come with wooden wheels; old CDs make excellent super-fast wheels. Will you change the box shape to streamline it? Or add a spoiler?</p>

<p>Testing the Car 1 – Distance & Deviation</p>	<p>E&O - I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units. MNU 1-11a Using technology and other methods, I can display data simply, clearly and accurately by creating tables, charts and diagrams, using simple labelling and scale. MTH 1-21a I can share my thoughts with others to help develop ideas and solve problems. TCH 0-04c I can adapt and improve my ideas and can express my thinking in different ways. TCH 1-04d I can design and construct models and explain my solutions. TCH 1-09a</p>	<p>Testing the Car involves</p> <ul style="list-style-type: none"> • You need a ramp to test the car and a smooth floor for the car to go onto • You will want to measure how far it goes and how much it deviates from a straight line (at the celebration event they use tape or ribbon to mark a fan shape on the test zone) • Why should you “release” car instead of “pushing” car? (refer back to forces lesson) <p>Evaluation involves</p> <ul style="list-style-type: none"> • Which car went furthest/was straightest and why? • How could you change your model to improve it?
<p>Refining/remodelling Testing the Car 2</p>	<p>CES - I can develop ideas and take part in projects to make things. Strengths-1 I can share my thoughts with others to help develop ideas and solve problems. TCH 0-04c I can adapt and improve my ideas and can express my thinking in different ways. TCH 1-04d I explore ways to design and construct models. TCH 0-09a</p>	<ol style="list-style-type: none"> 1. Make sure you spend time refining the model and retesting it. 2. This process of tinkering with the design is key to the Engineering Habits of Mind (above). Discuss this with pupils – engineering is great for building resilience. If it does not work the first time, learn from it and try new things! 3. Repeat testing and Evaluation process above till the car is ready!
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<p>Project – Completion of Booklet/Paperwork</p>	<p>I can explore and experiment with sketching, manually or digitally, to represent ideas in different learning contexts. TCH 1-11a I can describe some of the kinds of work that people do and I am finding out about the wider world of work. HWB 1-20a I am learning to make notes under given headings and use them to understand information, explore ideas and problems and create new texts. LIT 1-15a I am learning to use my notes and other types of writing to help me understand information and ideas, explore problems, generate and develop ideas or create new text. LIT 1-25a By considering the type of text I am creating, I can select ideas and relevant information, organise these in a logical sequence and use words which will be interesting and/or useful for others. LIT 1-26a can convey information, describe events or processes, share my opinions or persuade my reader in different ways. LIT 1-28a / LIT 1-29a</p>	<p>It would be expected in P2/3 that pupils complete the Pupil Workbook – however this can be daunting for some.</p> <p>Looking at the Celebration Mark Sheet, pupils should be able to show evidence of their research, design ideas, final drawings, evaluation and record of changes to design and evidence of their safety feature.</p> <p>Some schools created a poster of their learning covering these key aspects to bring to the celebration event along with photographs, models and evidence of their experiments to create a showcase around their model.</p>
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