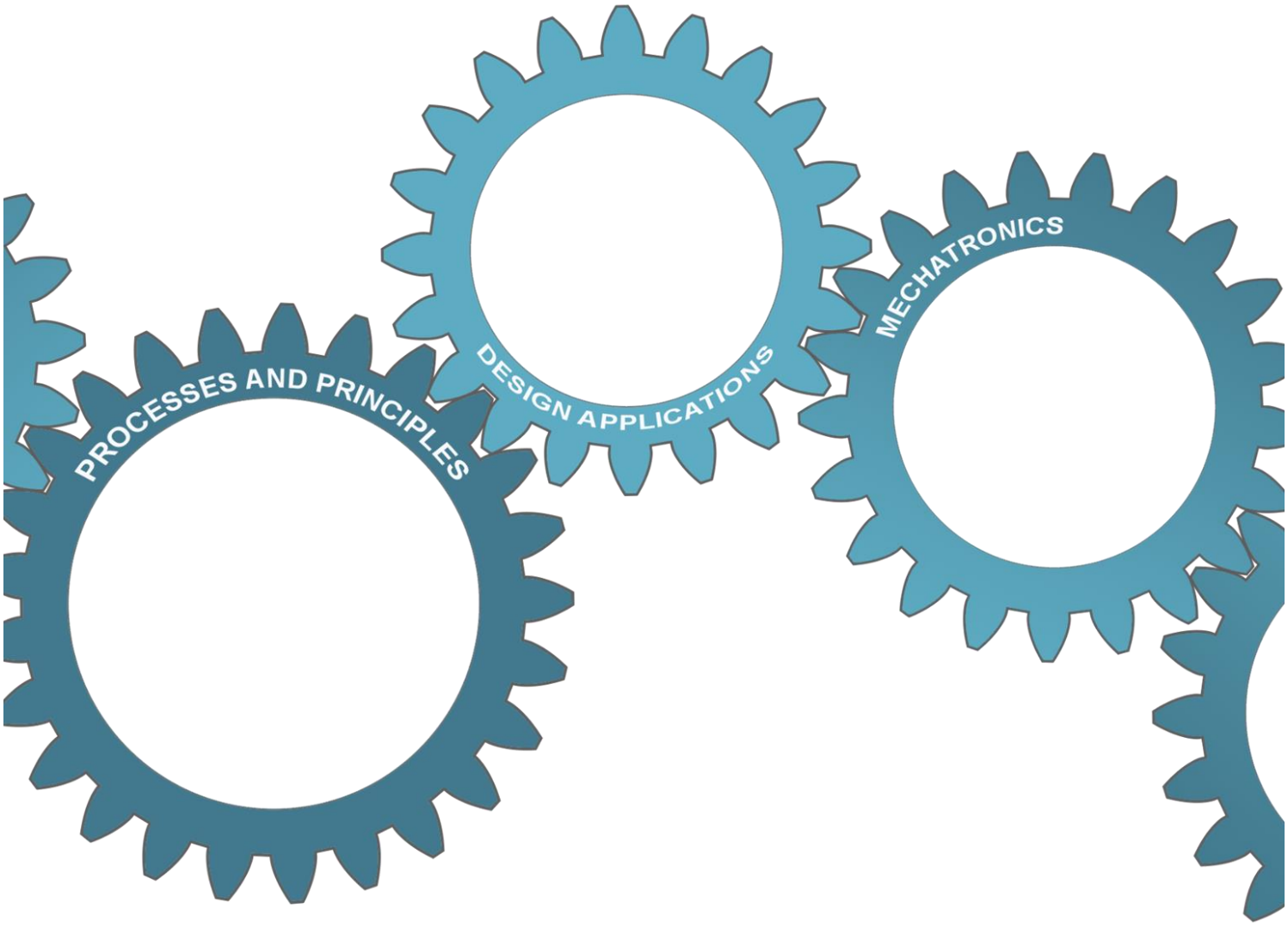
Oide

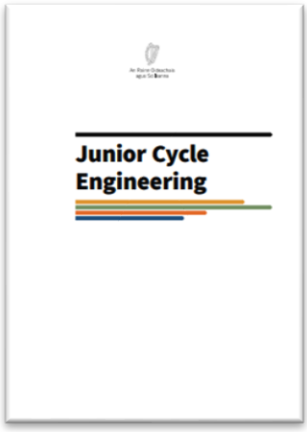
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí

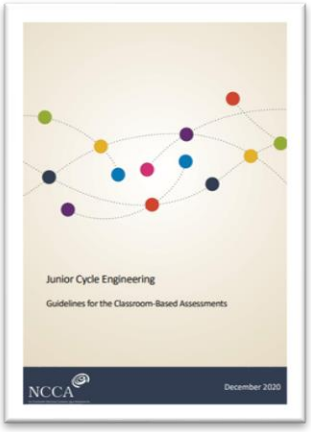
Supporting the Professional Learning of School Leaders and Teachers



Engineering

Professional Learning Booklet 2023-2024





Useful Links for today's PLE:

Junior Cycle Engineering Specification and Assessment Guidelines:
https://curriculumonline.ie/Junior-Cycle/Junior-Cycle-Subjects/Engineering/

Revised Assessment Arrangements for 2024:
https://www.gov.ie/pdf/?file=https://assets.gov.ie/270733/9d77a9be-41ac-4494-887d-b1963c81cd0a.pdf

CBA Key Dates 2023/24
https://ncca.ie/media/6316/key-dates-for-cbas-2023-2024_en.pdf

NCCA Senior Cycle Redevelopment
https://ncca.ie/en/senior-cycle/senior-cycle-redevelopment/

SEC Information Note on Junior Cycle Examinations 2022
https://www.examinations.ie/misc-doc/EN-AR-19213727.pdf

Oide Feedback
https://registration.oide.ie/Feedback

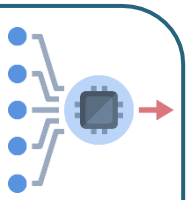
Click or scan the QR code to access the resources from today's session

Mechatronics Video Reflection Sheet

What is the purpose of your chosen Mechatronics System?

What component(s) are used for input?

What is/are the output component(s) and/or effects?



Explain how the system performs the function.

What are the benefits of using this system?

School: Coláiste Dún an Rí

- Rural co-educational school - c.700 students.
- 2nd Year Engineering, term three - 22 students.

Prior Learning:

Marking out, materials processing, and manufacturing skills. Assembly and finishing skills. Basic circuitry using a single motor and switched battery pack.

Focus of Learning:

- Assembly of parts and components
- Soldering skills
- Coding
- An application of mechatronics in a real-world context

Chosen Learning Outcomes:

1.9: **apply** suitable manufacturing processes to **engineer** a product
2.9: **modify** an existing product/design.
3.6: **configure** and **program** basic mechatronic systems using appropriate software
3.8: **build** and **test** a basic mechatronic system with specific inputs or outputs
3.9: **incorporate** basic mechatronics into their engineered products

Key Learning:

Using action verbs to support your thinking.

- Understand how an ultrasonic sensor works
- Configure a logical sequence to code a project and use a sensor effectively
- Build and test a mechatronic system
- Understand the difference between control systems and applied control systems

Communicate a practical learning experience to activate key learning:

What resources would be needed?

Electronic components – motors, SPST switch, wires, and solder.
Chassis parts – 5mm acrylic, wheels, sheet material for wings.
Lathe tools, soldering iron, tools for assembly.
Wheels, seat, motor brackets, M3 and M4 screws/nuts etc.
Micro:bit, robotics board, ultrasonic sensor.

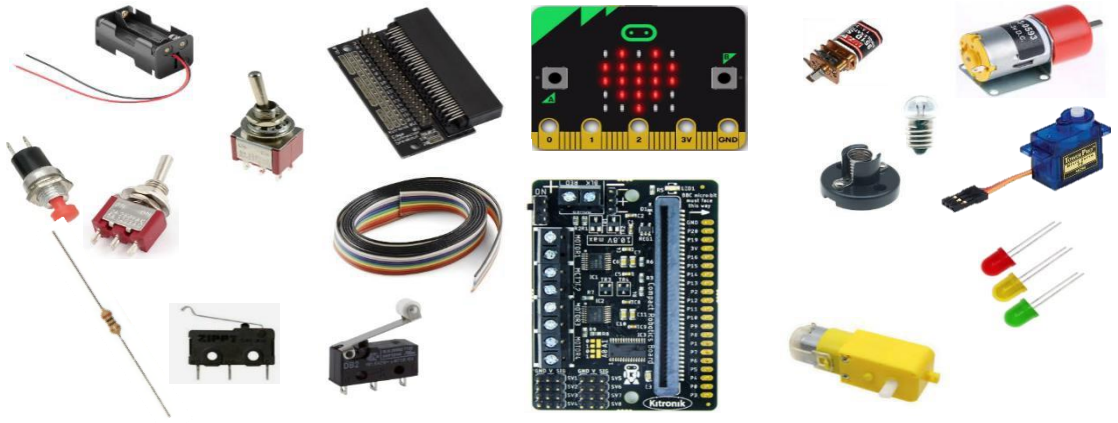
How could the key learning be assessed?

- Build/design a car that avoids collision with the obstacle effectively.
- Use the 'learning log' to record these moments, justifying the choices made throughout the process and the effects of the decisions on the final solution.
- Targeted teacher feedback given throughout.
- Peer feedback on agreed success criteria throughout.

This page is intentionally blank

Mechatronics Challenge

A selection of common components that could be found in the Engineering room are shown below. You may find these useful when designing your solution.



Outline a suitable sequence of actions to ensure the desired output from the car.

School: Coláiste Dún an Rí

- Rural co-educational school, c.700 students
- 2nd Year Engineering, term three

Prior Learning:

Marking out, materials processing, and manufacturing skills. Assembly and finishing skills. Basic circuitry using a single motor and switched battery pack.

Focus of Learning:

- Assembly of parts and components.
- Soldering skills.
- Coding.
- An application of mechatronics in a real-world context.

Chosen Learning Outcomes:

1.9: **apply** suitable manufacturing processes to **engineer** a product.
2.9: **modify** an existing product/design.
3.6: **configure** and **program** basic mechatronic systems using appropriate software.
3.8: **build** and **test** a basic mechatronic system with specific inputs or outputs.
3.9: **incorporate** basic mechatronics into their engineered products.

Key Learning:

Using action verbs to support your thinking.

- Configure a logical sequence to code a project and use a sensor effectively.
- Build and test a mechatronic system.
- Understand the difference between control systems and applied control systems.

Communicate a practical learning experience to activate key learning:

What resources would be needed?

How could the key learning be assessed?

School: St. Declan's Community College

- Rural co-educational school - c.840 students
- 2nd Year Engineering, term two - 24 students

Prior Learning:

The previous unit was a motorised crank and slider mechanism, focusing on hand tool skills, assembly/threading skills, and basic circuitry skills.

Focus of Learning:

The teacher has identified mechanisms and simple mechatronics as areas of key learning. Design and communication skills are also in focus.

Chosen Learning Outcomes:

1.5: **Research** applications of existing and emerging technological developments.

1.7: **Develop** engineered solutions to various challenges.

2.6: **Use** relevant information to enhance design function.

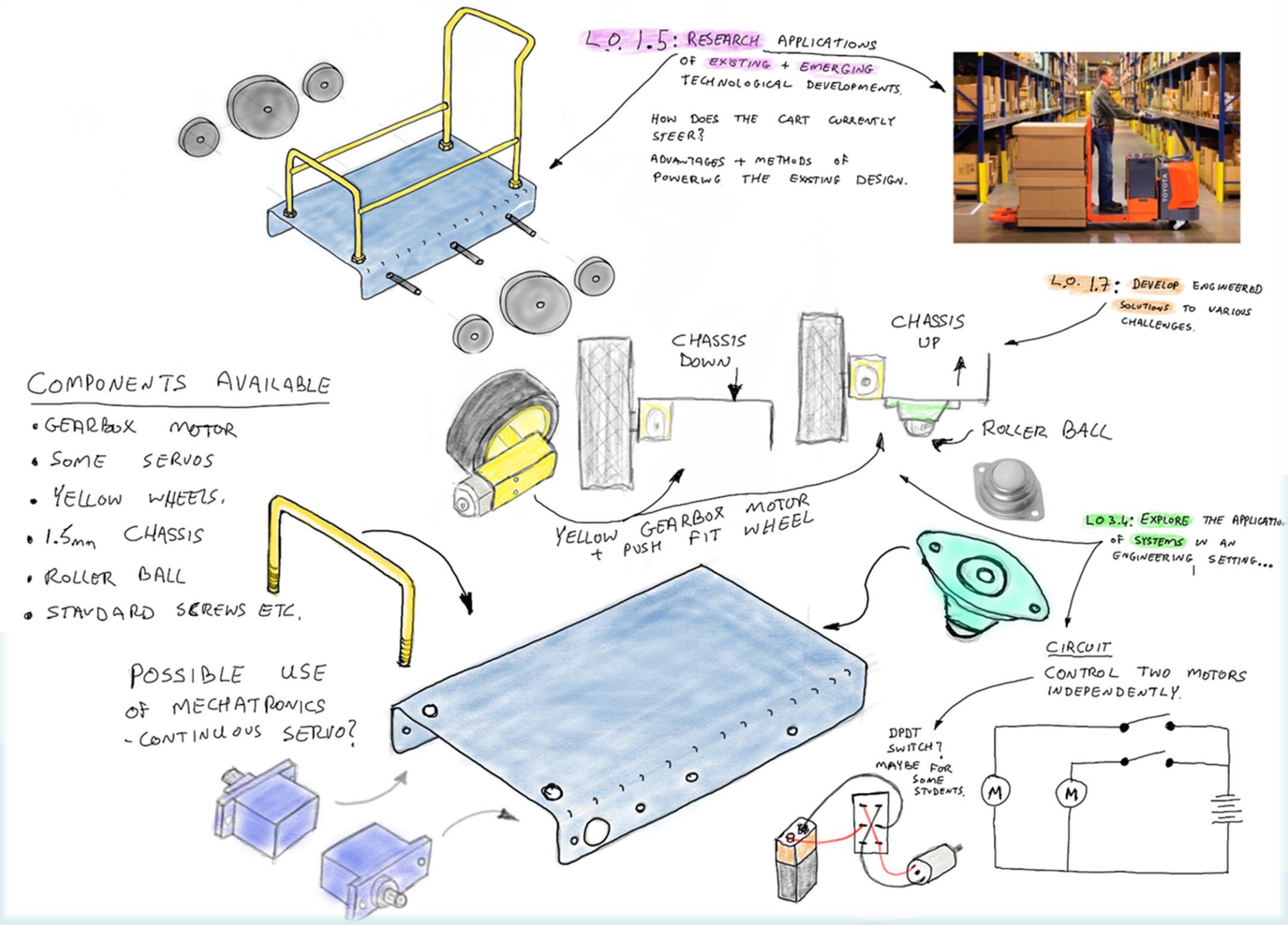
3.4: **Explore** the application of systems in an engineering setting such as the classroom, home, and industry.

Key Learning:

Using action verbs to support your thinking.

- Research and investigate the applications and engineering concepts behind common steering systems.
- Recognise applications of motors and mechanisms in steering and drive systems.
- Understand and appreciate the benefits of using a basic control system to enhance function in a practical application, such as the warehouse cart.

Communicate a practical learning experience to activate key learning:

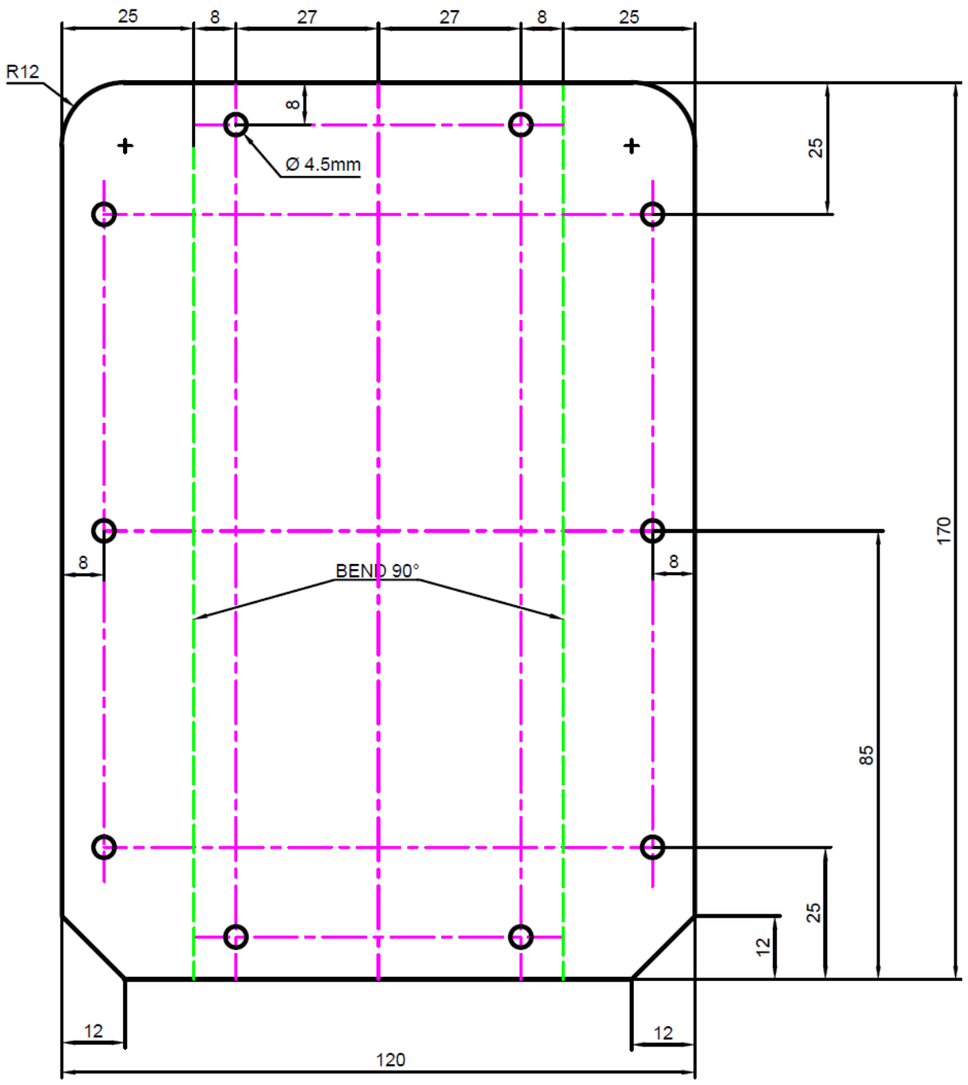


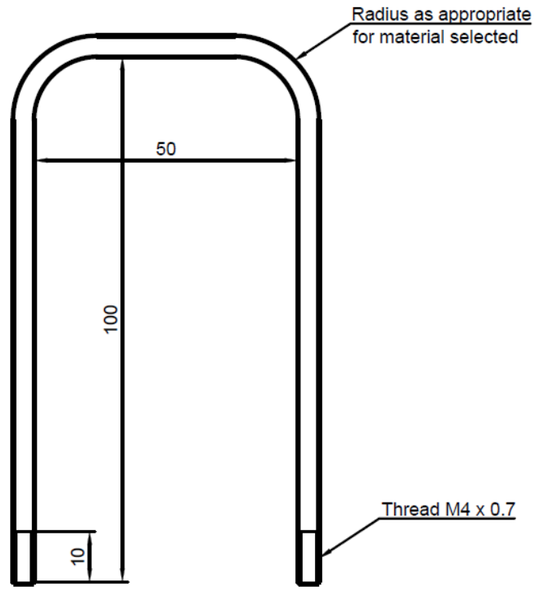
What resources would be needed?

Electronic components – motors, switches, wires, solder, etc.
Chassis, wheels, and brass/steel rod.
Selection of standard wheels, soldering iron, and tools for assembly
Screws/nuts etc. as required.
Drills, lathe, threading tools, etc.

How could the key learning be assessed?

- Describe the application of mechanisms in a range of steering systems.
- Use research-based knowledge to create a suitable design to solve the given problem.
- Effectively communicate their design using suitable media.
- Manufacture the given solution using prior learning to achieve function.
- Correctly wire and assemble electronic components to achieve function.
- A folio that documents the student's progression through the challenge and the decisions that effected the chosen design.



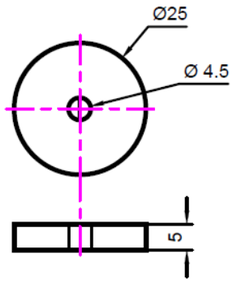


CART PROJECT

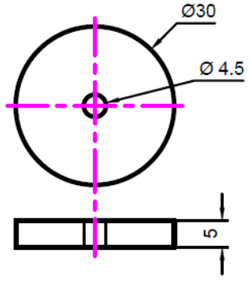
Part: Handle
Quantity: 2
Material: Brass Round Bar
Size: 250 x Ø4mm
Thread as indicated.
N.B: Sizes indicative only, resize as appropriate for design

CART PROJECT

Part: Chassis
Quantity: 1
Material: Aluminium
Size: 170 x 120 x 1.5mm
ALL HOLES Ø 4.5mm



Part: Balance Wheels
Quantity: 4
Material: Aluminium or similar
Size: Ø25 x 5mm
Embellish as appropriate



Part: Centre Wheels
Quantity: 2
Material: Aluminium or similar
Size: Ø30 x 5mm
Embellish as appropriate
Knurl if desired

Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

Engineering – Research on Motors and Mechanisms

Name: _____

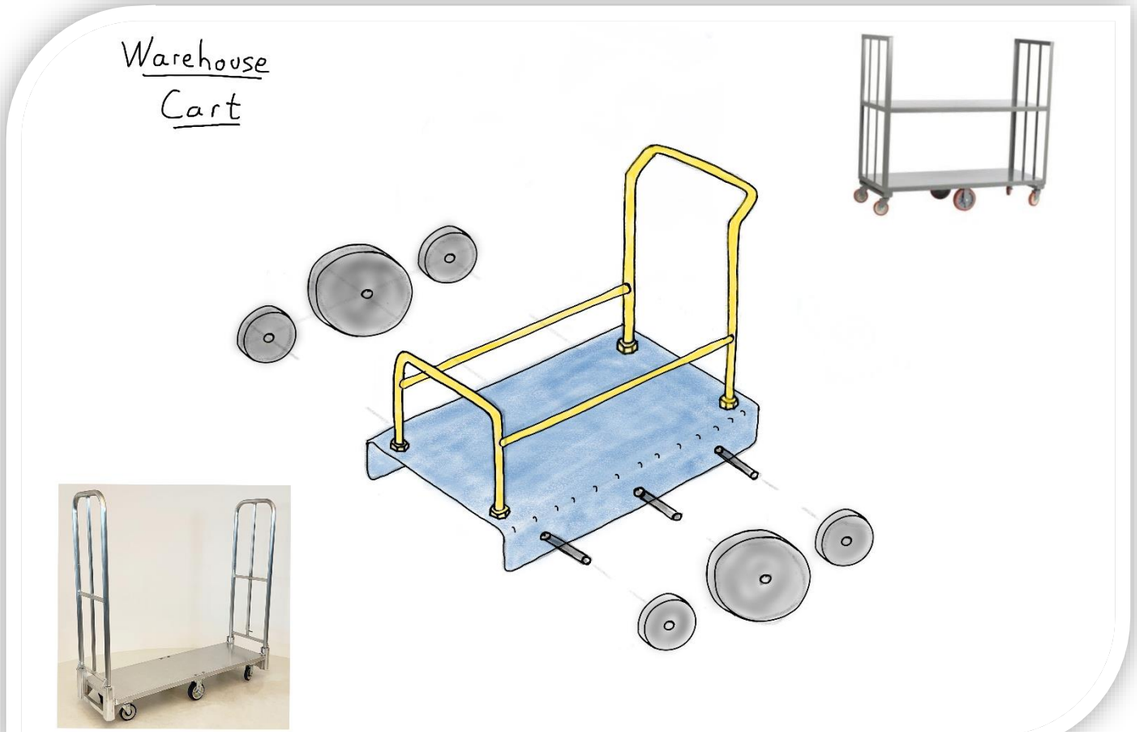
Use this page to show your research about the topic.
You should explore a wide range of research and be creative in the way you present your findings.
Use additional pages if necessary.

Engineering – Project Logbook

You are the on-site engineer in a warehouse for a busy distribution company. The company are seeking to upgrade their existing fleet of manual warehouse carts, which are all similar to the traditional U boat cart design as shown below.

The company would like to add a drive system to the carts to reduce physical strain on workers and to allow for faster and easier transportation of heavy loads. They have tasked you, the engineer, with upgrading their existing carts to incorporate:

- A motorised drive system to reduce physical strain on the workers.
- A simple method of steering to navigate the aisles and obstacles in the warehouse.



Reflection Point: What am I being asked to do?

_____

_____

Success Criteria for Research- My research should:

- Come from a variety of trusted sources
- Contain primary and secondary sources
- Be relevant to the task
- Have up-to-date information

Initial Research: Using a variety of sources, consider the following:

What is this cart used for?

_____

_____

How is this cart moved?

_____

_____

How does the user currently steer the cart?

_____

_____

_____

Further Research:

Give examples of steering systems that are commonly used? How could I apply this to my cart?

_____

_____

_____

_____

List examples of drive systems that are commonly used? How could I apply this to my cart?

_____

_____

_____

_____

_____

For support on research and design, you can access ‘My Design Guide,’ here

Steering systems that might work:
Sketch ideas for steering systems you feel might suit the cart.

Drive systems that might work:
Sketch ideas for drive systems you feel might suit the cart.

Success Criteria for Design- My design should:

- Have a motor control to reduce physical strain when using the cart
- Incorporate a simple method to steer the cart
- Fit on the given cart chassis
- Sketches should be neat, rendered appropriately, and labelled

My Design: Sketch out your suggested design for the upgraded U boat cart below.

Looking back, what did I already know and think about this topic / problem / challenge that helped me?

_____

_____

_____

On reflection, have I created a solution that meets the needs of this project/brief? If so, how?
If not, why?

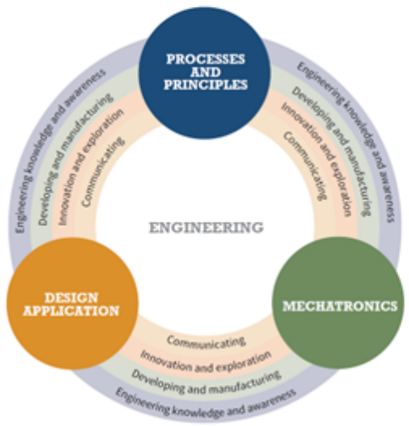
_____

_____

_____

Oide
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers

Junior Cycle Engineering – Learning Outcomes



Apply: select and use information and/or knowledge and understanding to explain a given situation or real circumstances

Appreciate: recognise the meaning of, have a practical understanding of

Build: construct by putting parts or material together

Choose: pick out as being the best or most appropriate of two or more alternatives

Configure: arrange or put together in a particular form or configuration

Communicate: use visual, gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand

Create: process and give form to the topic that is to be created using selected methods and material and/or to give the material used a new form

Demonstrate: prove or make clear by reasoning or evidence, illustrating with examples or practical application

Design: planning the features of a solution that solves a perceived user problem

Develop: advance a piece of work or an idea from an initial state to a more advanced state

Engage: enter into or become occupied by an activity or interest; to attract or hold interest and attention

Engineer: develop/build an item for a specific purpose that includes critical-to function components

Evaluate: collect and examine evidence to make judgements and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgements about the ideas, solutions or methods

	Strand 1: Processes and principles In this strand, students employ the fundamental processes and principles of engineering by applying their knowledge of materials and processes to manufacture and design products. Students develop an engineering mindset as they appreciate that accuracy and precision, together with the use of established engineering principles and processes lead to the production of innovative and efficient solutions of high quality and finish.	Strand 2: Design application In this strand, as they develop an engineering mindset, students learn about the key stages of the engineering design and manufacture process. They learn about the importance of design for both the end-user experience and the economic and social impact of the product. They discover how the combination of informed choice of materials and correct processes produces a solution that is functional and efficient. Students come to appreciate the value of good project management and learn how to manage themselves and the process of product development from design to manufacture.	Strand 3: Mechatronics In this strand, students may work with a combination of mechanical, manufacturing, electronic and computing systems and software to explore relationships between simple inputs, processes and outputs. They will learn about systems, and how they can be coordinated to ensure the desired output. Students develop the mindset to appreciate how control systems operate on a larger scale, and how the design of control systems can impact on the environment and sustainability. They appreciate the role that engineers have in employing 'systems thinking' to design products and services that contribute to a better future.
	Students should be able to:	*Students should be able to:*	*Students should be able to:*
Engineering knowledge and awareness The learning outcomes in this element are designed to raise student awareness and develop knowledge of relevant engineering principles and developments. Students will learn how to use the materials and equipment available to them in Engineering to inform their decisions about material and resource selection to engineer a product or solution.	1.1 **understand** the concepts and approaches that are required when solving an engineering problem 1.2 **demonstrate** a range of manufacturing processes 1.3 **recognise** and adhere to health and safety standards 1.4 **understand** the properties associated with a range of engineered materials	2.1 **understand** the key stages of the engineering design process 2.2 **evaluate** the factors that influence design 2.3 **choose** a suitable material to **engineer** a product	3.1 **explain** the operation of basic mechatronic systems 3.2 **investigate** relationships between inputs, processes and outputs for basic control systems 3.3 **appreciate** the application of mechanisms in a controlled system
Innovation and exploration In this element, the learning outcomes encourage students to explore the applications of engineering in the world around them. Students research existing and emerging developments and gain an appreciation of their impact and potential application to an engineered product.	1.5 **research** applications of existing and emerging technological developments 1.6 **engage** with the various engineering disciplines by relating them to everyday application	2.4 **explore** how design impacts on the function and quality of a product including ergonomic considerations 2.5 **apply** appropriate engineering concepts and approaches in the execution of their design solutions 2.6 **use** relevant information to enhance design and function	3.4 **explore** the application of systems in an engineering setting such as the classroom, home and industry 3.5 **investigate** the impact of mechatronics on the environment and society 3.6 **configure** and **program** basic mechatronic systems using appropriate software 3.7 **design** a basic mechatronic system either individually or collaboratively
Developing and manufacturing In this element, the learning outcomes develop the student's abilities to produce products and solutions through various materials. Students combine their learning from other elements to engineer products to a high, functional standard. The key focus is on efficiency, accuracy, precision and high-quality finish.	1.7 **develop** engineered solutions to various challenges 1.8 **identify** appropriate tools and equipment specific to a task 1.9 **apply** suitable manufacturing processes to **engineer** a product 1.10 **demonstrate** high-quality work, to include accuracy and surface finish	2.7 **apply** their knowledge of the properties associated with a range of engineering materials 2.8 **manufacture** a product from a working drawing 2.9 **modify** an existing product/design 2.10 **incorporate** basic project management techniques	3.8 **build** and **test** a basic mechatronic system with specific inputs or outputs 3.9 **incorporate** basic mechatronics into their engineered products
Communicating Throughout this element, the learning outcomes encourage students to communicate, through appropriate media, to relay technical information, design ideas and the impact engineering has on the environment around them.	1.11 **create** sketches, models and working drawings 1.12 **interpret** working drawings 1.13 **use** appropriate technical language and notations	2.11 **present** ideas through modelling and prototyping, using appropriate media 2.12 **communicate** their design decisions using suitable media	3.10 **represent** key information using appropriate media 3.11 **justify** their choice of the most appropriate system or systems for a specified purpose

Explain: give a detailed account including reasons or causes

Explore: to think or talk about something in order to find out more about it

Identify: recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature

Incorporate: take in or contain something as part of a whole

Interpret: use knowledge and understanding to recognise trends and draw conclusions from given information

Investigate: observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions

Justify: give valid reasons or evidence to support an answer or conclusion

Manufacture: something made from raw materials by hand or by machinery

Modify: to alter one or more particulars of an object/product

Present: make objects perceivable for others

Program: to instruct a device or system to operate in a particular way or at a particular time

Recognise: identify facts, characteristics or concepts that are critical (relevant/ appropriate) to the understanding of a situation, event, process or phenomenon

Represent: bringing clearly and distinctly to mind by use of description or imagination

Research: the study of materials and sources in order to establish facts and reach new conclusions; revision of accepted theories or laws in the light of new facts

Test: establish the quality, performance, or reliability of something

Understand: have and apply a well-organised body of knowledge

Use: apply knowledge or rules to put theory into practice; employ something in a targeted way

Scan or click on the QR code to access the Junior Cycle Engineering specification at curriculumonline.ie

Student Context:

Prior Learning:

Focus of Learning:

Chosen Learning Outcomes:

Key Learning:
Using action verbs to support your thinking.

Communicate a practical learning experience to activate key learning:

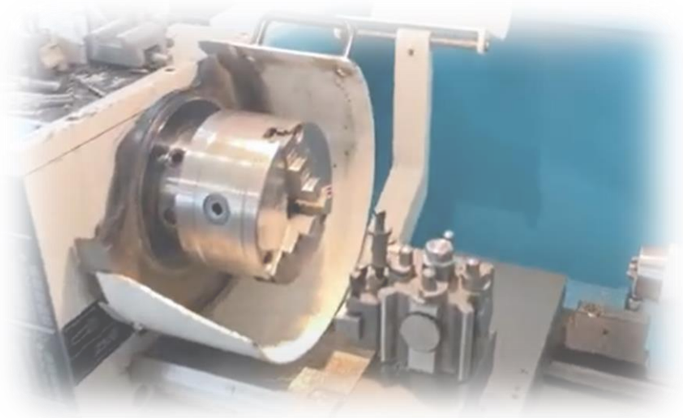
What resources would be needed?

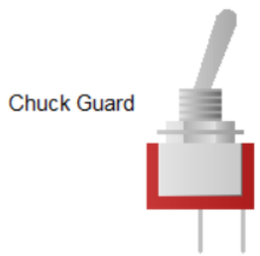
How could the key learning be assessed?

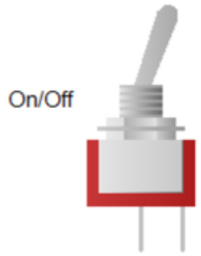
Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

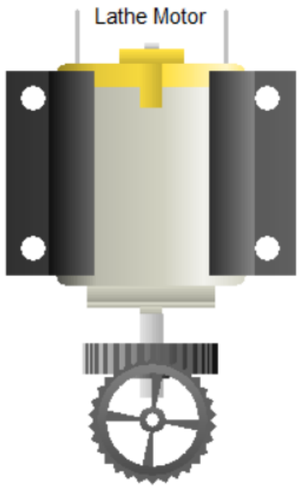
Logic Gates Worksheet 1

Having watched the lathe video, design a simple logic circuit to control the lathe using two inputs, the chuck guard, and the On/Off switch.









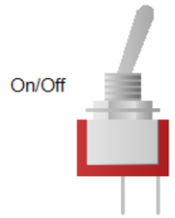
Scan this QR code to view a stimulus video for this activity.

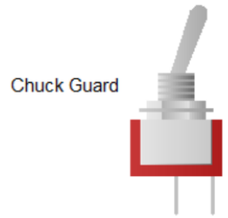
Draw a logic gate symbol, in the box opposite, to represent the circuit you have completed above.
The logic gate that could control this circuit is called a_____.

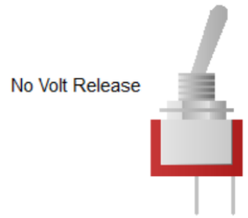
Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

Logic Gates Worksheet 2

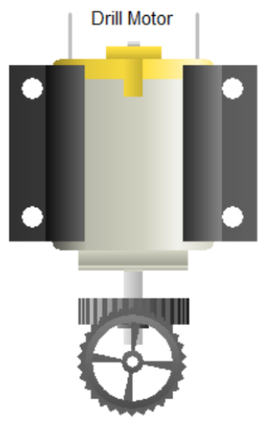
Design a logic circuit to safely operate the drill when required by the student.







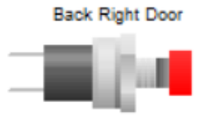
Scan this QR code to view a stimulus video for this activity.



Could you represent this circuit using a symbol, or a group of symbols?
Sketch your solution in the box opposite.

Logic Gates Worksheet 3

Design a circuit to turn on the comfort light inside the car if any of the doors are opened.



Scan this QR code to view a stimulus video for this activity

Draw a logic gate symbol in the box to the right to represent the circuit you completed above.
The logic gate that could control this light is called a_____.

Oide Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí Supporting the Professional Learning of School Leaders and Teachers

Logic Gates Worksheet 4

Alarms, such as typical home alarms use simple logic gates to operate. Draw a suitable circuit using a logic gate(s) to sound the siren if either the front or back door is opened.

Scan this QR code to view a stimulus video for this activity

Input A – Front Door

Input B – Back Door

Output C – Alarm Siren

Oide
Tacú leis an bhFoghlaim Ghairmiúil i measc Ceannairí Scoile agus Múinteoirí
Supporting the Professional Learning of School Leaders and Teachers