Scheme of work – R015 Manufacturing a one-off product

## About this scheme of work

**Our redeveloped Cambridge National in Engineering Manufacture J823 is for first teaching from September 2022.**

This qualification provides lots of flexibility, allowing you to find the best route to suit your centre’s needs.Our Curriculum planner shows you at a high level how you could teach the course over two or three years. Our schemes of work provide examples for how you could deliver each unit, integrating the knowledge and understanding learned in the externally assessed unit.

All schemes of work should provide an opportunity for integrating the knowledge and understanding learned from the externally assessed unit content alongside the NEA assessment content. This scheme of work provides one example for delivery of this unit. You may find that a different approach would work better in your centre. We have provided a blank template should you wish to create your own or adapt one of the approaches provided.

You’ve given us lots of feedback on what you need from a scheme of work, so we’ve made sure this resource features:

* a **unit-specific** and **lesson by lesson** approach
* **simple** and **editable** Word format – or you can use our [blank template](https://www.ocr.org.uk/Images/639549-scheme-of-work-template.docx) to create your own version
* links to our [curriculum planner’s first model](https://ocr.org.uk/Images/619713-curriculum-planner.docx) which is one teacher teaching the qualification over two years, broken down into half terms
* each lesson’s **key words**
* **ideas** for teaching and learning with useful **links**
* some ‘warm up’ teaching ideas if you’re teaching over three years.



**Our redeveloped Cambridge Nationals can be tailored to suit your needs – so this scheme of work and the lesson ideas are only suggestions.**

## Units and guided learning hours

Here is a reminder of the **three mandatory units** in the redeveloped Cambridge National in Engineering Manufacture:

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| **Unit** | **Unit title** | **Guided learning hours (GLH)** | **How are they assessed?** | **Mandatory or optional?** |
| R014 | Principles of engineering manufacture | 48 | E | M |
| **R015** | **Manufacturing a one-off product** | **36** | **NEA** | **M** |
| R016 | Manufacturing in quantity | 36 | NEA | M |

## Assumptions

* You will adapt the SOW and lesson content to match your own timetabling arrangements and will choose how to spread the 36 GLH over the two years as best fits your needs. We have worked on the basis that the average lesson time is around 45 minutes.
* Students can access some resources outside of lessons for any online homework or extension tasks.
* You will refer to the [specification](https://www.ocr.org.uk/Images/610947-specification-cambridge-nationals-engineering-manufacture-j823.pdf) as the key document for detailed insight into the qualification’s content and assessment requirements.

## **Summary of software/other equipment in this scheme of work**

* Engineering drawings of parts/components to manufacture
* Engineering materials to manufacture parts/components (depends on manufacturing capabilities and equipment)
* Measuring equipment for marking out (e.g. rules, callipers, micrometers, squares, protractors, height gauge etc.)
* Marking out equipment (e.g. dividers, scribers, surface plates, punches etc.)
* Hand tools (e.g. saws, files, guillotine, press, taps, dies etc.)
* Manually controlled machines (e.g. pillar drill, lathe, milling machine etc.)

## Week-by-week scheme of work with time allowed for working on NEA at end of delivery and practice.NEA work could be undertaken in parallel with delivery to shorten total delivery and assessment time. Term 1 can start when required (starts beginning of Year 10 in curriculum planner).

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|  Term 1 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Interpreting engineering drawings** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | You could begin this unit with an introduction to the context of the unit being a highly practical in which students will learn practical skills in one-off manufacture and undertake a practical assessment activity.In this lesson you could:* introduce engineering drawings and their importance to manufacturing one-off parts/components
* show students example engineering drawings for simple parts/components to check what features they can already identify.

Students will learn about engineering drawings, drawing conventions and features in Unit R014 and so you could use this to complement this unit.  | **Engineering drawings** | Interpret engineering drawings – required form and mechanical features. | [Designing – Working drawings](https://www.bbc.co.uk/bitesize/guides/zvgvgdm/revision/6) GCSE Design and Technology Revision - BBC Bitesize (bbc.co.uk)[Guide to Engineering drawing conventions](http://www.design-technology.info/IndProd/drawings/) (design-technology.info) | R014Students will learn how to interpret engineering drawings.R016Students will interpret engineering drawings for scale manufacture. |
| 2 | TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | In this lesson you could continue to work with engineering drawings in preparation for manufacturing a one-off components by:* interpreting features of third angle orthographic projection drawings of components
* providing sample drawings of parts/components for students to interpret working in small groups
* tasking students to produce basic copies of engineering drawings.
 | **Engineering drawings****Orthographic projection** | Interpret engineering drawings – required form and mechanical features. | [Introduction to Orthographic Projection](https://static.sdcpublications.com/multimedia/9781630570521-sample/ege/ortho/ortho_page1.htm) (sdcpublications.com) | R014Students will learn how to interpret engineering drawings.R016Students will interpret engineering drawings for scale manufacture. |
| 3 | TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | For this lesson you could continue engineering drawing by looking at drawings with mechanical features:* threads
* holes
* chamfers
* countersinks
* knurls.

Students could already be familiar with these from work in Unit R014. You could:* provide drawings showing these features for students to interpret
* relate the mechanical features shown to how they translate to actual features on component, using actual components if available (e.g. how a knurl is represented on a drawing, and how it is appears on a physical part/component)
* task students to produce quick and simple drawings showing mechanical features.
 | **Engineering drawings****Mechanical features** | Interpret engineering drawings – required form and mechanical features, dimensions, and characteristics. | [TES Engineering Drawing resource](https://www.tes.com/teaching-resource/engineering-drawing-resource-11420865) (tes.com)[note – some resources have download fee][Acronyms and Abbreviations in Engineering](https://blog.draftsperson.net/acronyms-and-abbreviations-in-engineering/) (draftsperson.net)[How to use a Knurling Tool](https://technologystudent.com/equip1/knurl1.htm) (technologystudent.com) | R014Students will learn how to interpret engineering drawings.R016Students will interpret engineering drawings for scale manufacture. |
| 4 | TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | In this lesson on engineering drawings and their interpretation you could look at dimensions and how surface finish is communicated:* linear measurements
* radius
* diameter
* tolerances
* surface finish.

Again, you could do this by:* provide drawings showing dimensions and surface finishes for students to interpret
* tasking students to interpret tolerances from engineering drawings, including the maximum and minimum allowable dimensions during manufacturing.
 | **Engineering drawings****Dimensions and characteristics****Surface finish** | Interpret engineering drawings – required form, mechanical features, dimensions, characteristics, and surface finish. | [TES Engineering Drawing resource](https://www.tes.com/teaching-resource/engineering-drawing-resource-11420865) (tes.com)[note – some resources have download fee][Graphic communication – some resources](http://www.duncanrig.s-lanark.sch.uk/pupil-zone/technical-education/technical-education-bge-s2-elective/technical-education-bge-s2-elective-course-outline/)(duncarig.s-lanark.sch.uk) | R014Students will learn how to interpret engineering drawings.R016Students will interpret engineering drawings for scale manufacture. |
| 5 | TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | In this final lesson on interpreting engineering drawings in preparation for manufacture you could consolidate this by:* supplying drawings for parts/components to be used as examples for manufacture in the remainder of this unit for interpretation
* tasking students to mark up the drawings to show key features and dimensions being communicated.

Students will need to interpret engineering drawings elsewhere in this unit and in the assessment activity, so will need to revisit this topic area as necessary. | **Engineering drawings****Consolidation** | Interpret engineering drawings – required form, mechanical features, dimensions, characteristics, and surface finish. | [TES Engineering Drawing resource](https://www.tes.com/teaching-resource/engineering-drawing-resource-11420865) (tes.com)[note – some resources have download fee][Graphic communication – some resources](http://www.duncanrig.s-lanark.sch.uk/pupil-zone/technical-education/technical-education-bge-s2-elective/technical-education-bge-s2-elective-course-outline/)(duncarig.s-lanark.sch.uk) | R014Students will learn how to interpret engineering drawings.R016Students will interpret engineering drawings for scale manufacture. |

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| Term 2 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Planning and risk assessment** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA1Planning the production of a one-off product1.2 Prepare a production plan to manufacture a one-off product | For the next series of lessons, you could focus on planning in preparation for manufacturing one-off components, and also on risk assessment.You could begin by:* introducing the importance of planning in preparation for manufacturing
* using simple planning activities which are not directly related to show how plans are a series of steps (e.g. making a drink, arranging travel to school)
* highlighting the key components/headlines of a production plan:
	+ materials required
	+ processes, tools, and equipment required
	+ sequence of operations
	+ health and safety considerations
	+ quality control requirements.

Students will learn more about processes, tools, equipment, quality control etc. in this unit, so will need to revisit planning as their knowledge develops, for planning for practice activities and as part of their assessment activity. | **Planning** | Recall and apply planning processes to prepare production plan. | [Planning - Time Charts](https://technologystudent.com/designpro/timechart.htm) (technologystudent.com)[Template](https://www.technologystudent.com/despro_flsh/prodflow1.html) (technologystudent.com)[What is a Gantt Chart?](https://www.gantt.com/) Gantt Chart Software, Information, and History(gantt.com)[The Ultimate Flowchart Guide](https://www.zenflowchart.com/flowchart/?web=1&wdLOR=c72CF93BB-301A-4E32-A2D7-7AC886AB0269)(zenflowchart.com)Flowchart symbols, tutorials and examples  | R016Students will use planning processes to plan for scale manufacture. |
| 2 | TA1Planning the production of a one-off product1.2 Prepare a production plan to manufacture a one-off product | In this lesson on planning, you could continue by:* providing example manufacturing plans for students to investigate and discuss
* supplying incomplete manufacturing plans for students to complete missing elements.
 | **Planning** | Recall and apply planning processes to prepare production plan. |  | R016Students will use planning processes to plan for scale manufacture. |
| 3 | TA1Planning the production of a one-off product1.3 Carry out a risk assessment | The next two lessons could focus on the important area of risk assessment.In the first lesson you could:* introduce risk assessment, and why it is important in any manufacturing activity
* explain the terms hazard and risk
* develop a quiz with photographs for students to identify hazards and their associated risks
* introduce students to the legal requirements for safe working and a safe working environment including the work of the Health and Safety Executive.
 | **Risk assessment** | Undertake risk assessment. | [Managing risks and risk assessment at work – Overview -HSE](https://www.hse.gov.uk/simple-health-safety/risk/index.htm)(hse.gov.uk)[Health and Safety at Work etc Act 1974 – legislation explained](https://www.hse.gov.uk/legislation/hswa.htm)(hse.gov.uk)[Safety signs and signals. The Health and Safety Regulations 1996. Guidance on Regulations - L64](https://www.hse.gov.uk/pubns/books/l64.htm) (hse.gov.uk)[What are the five steps to risk assessment?](https://worksmart.org.uk/health-advice/health-and-safety/hazards-and-risks/what-are-five-steps-risk-assessment) (worksmart.org.uk) | R016Students will undertake risk assessments when preparing to use CNC machines, and when quality checking components. |
| 4 | TA1Planning the production of a one-off product1.3 Carry out a risk assessment | In the second lesson on risk assessment, you could:* show students sample risk assessments
* carry out a simple demonstration risk assessment
* illustrate how control measures are used, including those available in your setting
* task students, working in groups, to undertake and discuss a risk assessment.

Students will continually need to address risk throughout any practical work they do in this units, so will need to use or complete risk assessments for these activities. | **Risk assessment** | Undertake risk assessment. | [Managing risks and risk assessment at work – Overview -HSE](https://www.hse.gov.uk/simple-health-safety/risk/index.htm)(hse.gov.uk)[Health and Safety at Work etc Act 1974 – legislation explained](https://www.hse.gov.uk/legislation/hswa.htm)(hse.gov.uk)[Safety signs and signals. The Health and Safety Regulations 1996. Guidance on Regulations - L64](https://www.hse.gov.uk/pubns/books/l64.htm) (hse.gov.uk)[What are the five steps to risk assessment?](https://worksmart.org.uk/health-advice/health-and-safety/hazards-and-risks/what-are-five-steps-risk-assessment) (worksmart.org.uk) | R016Students will undertake risk assessments when preparing to use CNC machines, and when quality checking components. |
| 5 | TA1Planning the production of a one-off product1.2 Prepare a production plan to manufacture a one-off product | In this lesson students could consolidate their knowledge, so far, on planning and risk assessment.You could:* task students to complete a production plan for a simple manufacturing activity
* task students to consider the hazards. and risks associated with the activity and to produce a simple risk assessment identifying control measures.
 | **Planning****Risk assessment****Consolidation** | Recall and apply planning processes to prepare production plan. | [Health and safety in engineering](https://www.hse.gov.uk/engineering/) (hse.gov.uk)- includes a booklet of health and safety in the engineering workshop to download | R016Students will use planning processes including risk assessment to plan for scale manufacture. |

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| Term 3 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Measuring and marking out** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA2Measuring and marking out2.1 Select and safely use equipment for marking out2.1.1 Equipment | Over the next series of lessons, you could introduce students to different types of measuring and marking out equipment, and how to use this for marking out in preparation for manufacture.In this lesson you could:* show the following measuring/marking out equipment:
	+ rules
	+ dividers
	+ scribers
	+ scribing blocks
	+ surface plates
* explain the function and application of each piece of equipment
* allow students to use selected measuring equipment to undertake simple measuring tasks (e.g. a rule to measure distances).
 | **Measuring equipment** | Recall features of measuring equipment used to mark out.  | [Equipment and Processes](https://technologystudent.com/equip1/equipex1.htm) See index page(technologystudent.com)[Marking out metal - YouTube](https://www.youtube.com/watch?v=V2QT2C5larE) | R014Students will learn about quality control techniques and how to measure parts.R016Students will use measuring equipment when undertaking quality control. |
| 2  | TA2Measuring and marking out2.1 Select and safely use equipment for marking out2.1.2 Marking out techniques | For this lesson you could introduce students to more comprehensive measuring equipment used when marking out.You could do this by:* showing the following measuring/marking out equipment:
	+ rules
	+ digital vernier callipers
		- external
		- internal
		- depth
	+ micrometres
		- external
		- internal
		- depth
	+ squares
	+ protractors
	+ height gauge
	+ Dial Test Indicator (DTI)
* explaining the function and application of each piece of equipment, and the types of dimension it can be used to measure
* allowing students to use selected measuring equipment to undertake simple measuring tasks (e.g. a vernier to measure an outside length, a micrometer to measure a diameter).
 | **Measuring equipment** | Recall features of measuring equipment used to mark out. | [Equipment and Processes](https://technologystudent.com/equip1/equipex1.htm) See index page(technologystudent.com)[Top-10 Mechanical Measuring Instruments (Every Mechanical Engineer should know)) - YouTube](https://www.youtube.com/watch?v=lou9kAFGOjk)[How to Read a Metric Vernier Caliper - YouTube](https://www.youtube.com/watch?v=vkPlzmalvN4)[How to Read a Metric Micrometer by WeldNotes.com - YouTube](https://www.youtube.com/watch?v=StBc56ZifMs)[HD How to Read a Metric Micrometer - YouTube](https://www.youtube.com/watch?v=vl-51zYDg10) | R014Students will learn about quality control techniques and how to measure parts.R016Students will use measuring equipment when undertaking quality control. |
| 3 | TA2Measuring and marking out2.1 Select and safely use equipment for marking out2.1.1 Equipment2.1.2 Marking out techniques2.2 Select and use measuring instruments | In this lesson you could continue introducing students to further measuring and marking out equipment.You could do this by:* showing the following measuring/marking out equipment:
	+ punches
	+ squares
	+ protractors
	+ angle plates
* explaining the function and application of each piece of equipment
* allowing students to use selected equipment to undertake simple tasks (e.g. how to use a centre punch to mark a spot to be drilled).
 | **Marking out****Measuring** | Use measuring equipment safely to mark out. | [[Equipment and Processes](https://technologystudent.com/equip1/equipex1.htm)](https://technologystudent.com/equip1/equipex1.htm) [See index page](https://technologystudent.com/equip1/equipex1.htm)[(technologystudent.com](https://technologystudent.com/equip1/equipex1.htm))[How to Use a Centre Punch (Pre-Drilling Operation) - YouTube](https://www.youtube.com/watch?v=r5vngxToqi4) | R014Students will learn about quality control techniques and how to measure parts.R016Students will use measuring equipment when undertaking quality control. |
| 4 | TA2Measuring and marking out2.1 Select and safely use equipment for marking out2.1.1 Equipment2.1.2 Marking out techniques2.2 Select and use measuring instruments | For this lesson you could introduce the following techniques required when marking out:* datum
* centre lines
* circles
* hole positions
* profiles:
	+ square/rectangular
	+ angular
	+ radial.

You could do this by:* relating these to how they are represented on engineering drawings (students may already be familiar with this from previous work on drawings)
* showing how information on a drawing is translated into marking out
* providing practice marking out activities for students to complete.
 | **Marking out****Measuring** | Use measuring equipment safely to mark out. | [Guide to Engineering drawing conventions](http://www.design-technology.info/IndProd/drawings/) (design-technology.info)[[Equipment and Processes](https://technologystudent.com/equip1/equipex1.htm)](https://technologystudent.com/equip1/equipex1.htm) [See index page](https://technologystudent.com/equip1/equipex1.htm)[(technologystudent.com](https://technologystudent.com/equip1/equipex1.htm)) | R014Students will learn about quality control techniques and how to measure parts.R016Students will use measuring equipment when undertaking quality control. |
| 5 | TA2Measuring and marking out2.1 Select and safely use equipment for marking out2.1.1 Equipment2.1.2 Marking out techniques2.2 Select and use measuring instruments | In the final lesson on marking out, students could undertake practice activities to consolidate their knowledge.This could include:* using engineering drawings to practise marking out
* self-reviewing own work to check that marking out is complete and accurate
* peer reviewing each other’s work to check for accuracy
* review of completed marking out activities.

Students will need to return to making out as practical manufacturing tasks are undertaken throughout this unit, and for the assessment tasks. | **Marking out****Measuring****Consolidation** | Use measuring equipment safely to mark out. | [[Equipment and Processes](https://technologystudent.com/equip1/equipex1.htm)](https://technologystudent.com/equip1/equipex1.htm) [See index page](https://technologystudent.com/equip1/equipex1.htm)[(technologystudent.com](https://technologystudent.com/equip1/equipex1.htm)) | R014Students will learn about quality control techniques and how to measure parts.R016Students will use measuring equipment when undertaking quality control. |

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| Term 4 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Manually controlled processes** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA3Safely use processes, tools and equipment to make a product3.2 Tools and equipment | For the remainder of the taught elements of this unit, students will learn how to safely use tools and equipment. For each tool or piece of equipment this could follow a similar format:* familiarisation with function and operation
* safe working procedures, including risk assessment
* demonstration of safe use
* practice activities for students to complete
* review of outcomes.

The first lesson could be used to:* introduce students to the workshop setting
* explain health and safety procedures
* familiarise with workshop layout and rules
* highlight requirements for use of PPE.
 | **Manually controlled operations****Workshop safety** | Select and safely used saws and files. | [Health and safety in engineering](https://www.hse.gov.uk/engineering/) (hse.gov.uk)- includes a booklet of health and safety in the engineering workshop to download[Managing risks and risk assessment at work – Overview](https://www.hse.gov.uk/simple-health-safety/risk/index.htm)(hse.gov.uk)[Health and Safety at Work etc Act 1974 – legislation explained](https://www.hse.gov.uk/legislation/hswa.htm) (hse.gov.uk)[Safety signs and signals. The Health and Safety Regulations 1996. Guidance on Regulations - L64](https://www.hse.gov.uk/pubns/books/l64.htm)(hse.gov.uk) | R014Students will learn about manually controlled manufacturing processes, including the use and properties of materials. |
| 2  | TA3Safely use processes, tools and equipment to make a product3.2 Tools and equipment | Using the format of familiarisation, demonstration, practice, and review, in this first lesson you could introduce students to:* saws
	+ hacksaw
	+ junior hacksaw
* files.

Students could relate practical activities back to those covered theoretically in unit R014, where sawing and filing is introduced. | **Manually controlled operations****Sawing****Filing** | Select and safely used saws and files. | [How to use a hacksaw - YouTube](https://www.youtube.com/watch?v=G0NGoPF3Q6A)[Cutting Metal With a Hacksaw - YouTube](https://www.youtube.com/watch?v=v5TqhTpKDeQ)[8 Old School Tips For Better Hand Filing - YouTube](https://www.youtube.com/watch?v=h4KaiG7CpSQ)[Skillbuilder: 5 Tips for Using Files - YouTube](https://www.youtube.com/watch?v=32FUysj-Lu4) | R014Students will learn about sawing and filing, including the use and properties of materials. |
| 3 | TA3Safely use processes, tools and equipment to make a product3.2 Tools and equipment | For this practical lesson you could introduce students to:* guillotine
* press (for sheet bending of materials).

Wasting processes, including the guillotine, and pressing is introduced in Unit R114 and so students could relate theory with practice across both units. | **Manually controlled operations****Guillotine****Press** | Safely use guillotine and/or press. | [Sheet Metal Guillotine Introduction - Design at Loughborough University - YouTube](https://www.youtube.com/watch?v=hiSc_SgC2zA) | R014Students will learn about the guillotine and press, including the use and properties of materials. |
| 4 | TA3Safely use processes, tools and equipment to make a product3.2 Tools and equipment | In this lesson you could cover:* taps and dies.

Threading is introduced in Unit R014 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Taps****Dies** | Safely use taps and dies. | [Everything You Need to Know About Taps & Dies - Gear Up With Gregg's - YouTube](https://www.youtube.com/watch?v=CWCQ-hlQvdY) | R014Students will learn about taps and dies, including the use and properties of materials. |
| 5 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In the next few lessons you could introduce students to manually controlled machines.In preparation for these activities, in this lesson you could begin by:* introducing the types and location of machines in centre
* explaining the safety mechanisms in place (e.g. emergency stops, guarding)
* showing the PPE that must be worn when using machines.

In the first lesson on machines, you could:* introduce the drill (pillar drill)
* explain the key parts of the drill
* perform a risk assessment activity
* show the tooling and work holding required
* show safe setup of the drill, including setting speed of rotation if applicable
* demonstrate safe operation of the drill
* allow students to practise safely using the pillar drill.
 | **Manually controlled operations****Machine safety****Drilling** | Prepare for the safe use of manually controlled machines. | [Machine Drills](https://technologystudent.com/equip1/macdrl1.htm) (technologystudent.com)[How to Safely and Correctly use a Pillar Drill (aka Bench Drill) - YouTube](https://www.youtube.com/watch?v=IcJc2JmNeV8) | R014Students will learn about manually controlled machining processes, including safety measures. |

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| Term 5 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Manually controlled processes** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this lesson students could:* continue to practise safely using the pillar drill
* combine marking out activities, along with interpreting engineering drawings, to mark out hole positions to be drilled.
 | **Manually controlled operations****Drilling** | Safely use a drilling machine. | [Machine Drills](https://technologystudent.com/equip1/macdrl1.htm) (technologystudent.com)[How to Safely and Correctly use a Pillar Drill (aka Bench Drill) - YouTube](https://www.youtube.com/watch?v=IcJc2JmNeV8) | R014Students will learn about manually controlled machining processes, including the use and properties of materials. |
| 2  | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this lesson you could introduce students to turning using a lathe.You could:* introduce the lathe
* explain the key parts of the lathe
* perform a risk assessment activity
* show the tooling and work holding required
* show safe setup of the lathe, including selecting speed of rotation as applicable
* demonstrate safe operation of the lathe
* allow students to practise safely using the lathe.

Students will, over the next lessons, use the lathe to perform the following turning operations:* end facing
* parallel turning
* centre drilling
* grooves
* knurling
* parting off.

Turning is introduced in Unit R114 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Turning** | Safely use a lathe for turning operations. | [The Centre Lathe](https://technologystudent.com/equip1/mlathe1.htm) (technologystudent.com)[Learning to Use a Lathe, Part 1: Basic operation and facing cut - YouTube](https://www.youtube.com/watch?v=_Vw48i30SN8) | R014Students will learn about turning, including the use and properties of materials. |
| 3 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this lesson students could:* continue to practise safely using the lathe, learning how to perform each of the turning operations
* combine marking out activities, along with interpreting engineering drawings, to produce components that meet the requirements of a drawing.
 | **Manually controlled operations****Turning** | Safely use a lathe for turning operations. | [The Centre Lathe](https://technologystudent.com/equip1/mlathe1.htm) (technologystudent.com)[Parallel Turning - YouTube](https://www.youtube.com/watch?v=Z4LGUDz88VA) | R014Students will learn about turning, including the use and properties of materials. |
| 4 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this final lesson on turning students could:* continue to practise safely using the lathe, learning how to perform each of the turning operations
* perform more complex turning operations such as making grooves and knurls
* combine marking out activities, along with interpreting engineering drawings, to produce components that meet the requirements of a drawing
* self- and peer review the components they have manufactured.
 | **Manually controlled operations****Turning** | Safely use a lathe for turning operations. | [The Centre Lathe](https://technologystudent.com/equip1/mlathe1.htm) (technologystudent.com)[How to feed knurl on a metal lathe - the basics - YouTube](https://www.youtube.com/watch?v=YqwxsZVm3Xw) | R014Students will learn about turning, including the use and properties of materials. |
| 5 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this lesson you could introduce students to milling using a milling machine.You could:* introduce the milling machine
* explain the key parts of the milling machine
* perform a risk assessment activity
* show the tooling and work holding required
* show safe setup of the milling machine, including selecting speed of rotation as applicable
* demonstrate safe operation of the milling machine
* allow students to practise safely using the milling machine.

Students will, over the next lessons, use the lathe to perform the following milling operations:* facing
* slotting.

Milling is introduced in Unit R114 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Milling** | Safely use a milling machine for milling operations. | [The Vertical Miller](https://technologystudent.com/equip1/vert1.htm) (technologystudent.com)[Vertical Mill Tutorial 1: The Basics - YouTube](https://www.youtube.com/watch?v=FyuG-B95PQs) | R014Students will learn about milling, including the use and properties of materials. |

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| Term 6 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Manually controlled processes, measuring instruments** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this lesson students could:* continue to practise safely using the milling machine, learning how to perform each of the milling operations
* combine marking out activities, along with interpreting engineering drawings, to produce components that meet the requirements of a drawing.
 | **Manually controlled operations****Milling** | Safely use a milling machine for milling operations. | [The Vertical Miller](https://technologystudent.com/equip1/vert1.htm) (technologystudent.com) | R014Students will learn about milling, including the use and properties of materials. |
| 2  | TA3Safely use processes, tools and equipment to make a product3.1 Manually controlled machining operations | In this final lesson on milling students could:* continue to practise safely using the milling machine, learning how to perform each of the milling operations
* perform more complex milling operations such milling a slot
* combine marking out activities, along with interpreting engineering drawings, to produce components that meet the requirements of a drawing
* self- and peer review the components they have manufactured.
 | **Manually controlled operations****Milling** | Safely use a milling machine for milling operations. | [The Vertical Miller](https://technologystudent.com/equip1/vert1.htm) (technologystudent.com)[Milling T-slots. - YouTube](https://www.youtube.com/watch?v=0LJJNDDl4TQ) | R014Students will learn about milling, including the use and properties of materials. |
| 3 | TA3Safely use processes, tools and equipment to make a product3.3 Joining techniques | In the final series of taught lessons, students could be introduced to joining techniques starting with:* brazing.

In the first lesson you could:* introduce brazing
* explain the process by which brazing is used to join materials
* perform a risk assessment activity
* show the equipment required to perform brazing
* demonstrate how to safely join materials by brazing
* allow students to practise safely brazing.

Brazing is introduced in Unit R114 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Joining** | Safely perform joining operations. | [What is Brazing? | Skill-Lync - YouTube](https://www.youtube.com/watch?v=neL4CMdUpjg) | R014Students will learn about joining by brazing, including the use and properties of materials. |
| 4 | TA3Safely use processes, tools and equipment to make a product3.3 Joining techniques | In this lesson students could continue practising joining techniques using:* pop rivets.

In this lesson students could:* interpret engineering drawings to mark out and drill holes in preparation for joining materials using pop rivets
* perform a risk assessment activity
* safely join materials together using pop rivets and rivet gun
* self- and peer review the quality of the finished joint.

Riveting is introduced in Unit R014 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Joining** | Safely perform joining operations. | [Common Metal Shop Tools: Riveting - YouTube](https://www.youtube.com/watch?v=7M0RsmR5d6M)[What is a Pop Rivet? | Design Squad - YouTube](https://www.youtube.com/watch?v=9aoXmzdSf_I) | R014Students will learn about pop rivets, including the use and properties of materials. |
| 5 | TA3Safely use processes, tools and equipment to make a product3.3 Joining techniques | In this final lesson on joining techniques students could practise using:* mechanical fastenings
	+ nuts and bolts
	+ self-tapping screws.

In this lesson students could:* interpret engineering drawings to mark out and drill holes in preparation for joining materials using nuts, bolts and self-tapping screws
* perform a risk assessment activity
* safely join materials together, including selecting and using the appropriate tools (e.g. screwdrivers, spanners)
* self- and peer review the quality of the finished joints.

Temporary joining processes are introduced in Unit R014 as a manufacturing process, and so students could relate theoretical with practical work in this lesson. | **Manually controlled operations****Joining** | Safely perform joining operations. | [Metals – Joining methods](https://www.bbc.co.uk/bitesize/guides/zn2w7p3/revision/9) GCSE Design and Technology Revision - BBC Bitesize (bbc.co.uk)[Nuts and Bolts Sheet 1](https://technologystudent.com/joints/bolt1.htm) (technologystudent.com)[Types of Screws](https://technologystudent.com/joints/screws2.htm) (technologystudent.com) | R014Students will learn about mechanical fastenings, including the use and properties of materials. |

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| Term 7 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Working on OCR-set assignment (supervised)** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Working on OCR-set assignment Tasks | You could reserve a block of lessons for students to work on the Tasks within the OCR-set assignment. Alternatively, students could use this time to complete relevant assessment Tasks interleaved with other taught and practice lessons.**Time allowed for working on the OCR-set assignment is typically 10-12 hours.**Students must be supervised for safety purposes when undertaking any practical assessment work.In an early lesson you could:* introduce students to the OCR-set assignment brief and associated Tasks
* explain the marking criteria and how students will be assessed
* hold a class discussion to confirm the exact requirements for each Task
* ask students, working in small groups, to review and discuss the Set Assignment brief and confirm how they will produce and present evidence for assessment.
 |  | Understand the OCR-set assignment brief including Tasks and marking criteria.Understand how to record and present evidence for assessment. | Access resources via the qualification home page including:* OCR-set assignment briefs
* sample assessment materials
* candidate exemplars
* Supporting the moderation process (online training)
* examiner and moderator reports (for past series – after first assessment in 2024).

Note – some of the above resources will become available as the qualification develops. |  |
| 2 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 3 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 4 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 5 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |

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| Term 8 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Working on OCR-set assignment (supervised)** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 2  | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 3 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 4 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 5 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |

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| Term 9 |
| **Summary of what you will cover from the** [**curriculum planner**](https://www.ocr.org.uk/Images/619713-curriculum-planner.docx)**:** | **Working on OCR-set assignment (supervised)** |

| Lesson no. | Topic areas/sub topic areas  | Lesson ideas and activities | Lesson key words | Lesson outcome(s)At the end of the lesson, students will be able to: | Useful links/resources | How does this link to other units? |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 2  | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 3 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 4 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |
| 5 | Working on OCR-set assignment tasks | Working on Tasks continues. |  |  |  |  |

## Teaching over three years

Some centres may choose to start their delivery of the qualification earlier in Year 9, and so deliver over three years. The following topic areas are suggestions of what could form part of early delivery.

| Topic area | Warm up/introductory activities | Length of time activity may take |
| --- | --- | --- |
| TA1Planning the production of a one-off product1.1 Interpret an engineering drawing to identify information to facilitate manufacture | Students could practise interpreting third angle orthographic engineering drawings. This could complement the suggested warm up activity in R014 and focus on interpreting drawings in preparation for one-off manufacture. Drawings of components/parts could be used alongside physical parts for students to identify how the drawing is related to the manufacturing techniques required to manufacture the part. | 4-5 hours with additional time to practise interpreting third angle orthographic drawings. |
| TA1Planning the production of a one-off product1.2 Prepare a production plan to manufacture a one-off product1.3 Carry out a risk assessment | You could develop simple activities to allow students to produce plans, with sequence of steps, and risk assessments. These do not necessarily need to relate to manufacturing, and could be daily activities such as cleaning teeth, making a cup of tea etc. Students could use headed templates to produce plans and risk assessments. For a plan, typical headings could be step number; description of activity; materials required; equipment required; safety measures and quality checks. Risk assessment templates would include identifying hazards; associated risks; some determination of associated severity and likelihood, and control measures to reduce risks. | 4-5 hours with additional time to produce simple plans and risk assessments. |
| TA2Measuring and marking out2.1 Select and safely use equipment for marking out | Students could practise measuring and marking out with simple activities. This could be done using easily cut materials (e.g. card, modelling foam). You could give students engineering drawings to interpret and to measure, mark out and cut out the shape shown on a piece of card or using modelling foam. | 3-4 hours with additional time to practice marking out and cutting out. |
| TA3Safely use processes, tools and equipment to make a product3.2 Tools and equipment | You could introduce the engineering workshop setting to students and show them how to safely use basic tools and machines (e.g. saws, files, cutters, pillar drill).You could set them a task to manufacture a simple item. Complementary to the suggested warm up activity in Unit R014, if time allows you could also introduce basic machining processes using a lathe or milling machine. Examples items to manufacture could be a drill gauge or keyring. | 5-6 hours workshop practice with additional time for manufacturing a simple item. |

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