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# Introduction

This resource is a scheme of work (SoW) designed to support teachers’ delivery of the full GCSE Design and Technology course over a 2-year period. The scheme of work is not prescriptive, but simply a guided approach that will cover all the course content.

Included within this SoW are the following:

1. Reference to two mock examinations scheduled during the summer of Year 10 and the start of the Spring term of Year 11, which allow the teacher to select and use papers from the back catalogue of available exam series.
2. A plan of delivery based on 3 lessons per week, one double lesson and one single lesson. (The teacher can choose which lesson per week to assign to the double or single, depending on the strength and experience of the cohort/KS3 coverage).
3. Guidance to spread the course across a three-year delivery for those who wish to teach the course content in Year 9.
4. Suggested independent work and extension work that supports learner application of learning away from the classroom.
5. Suggested alternative content that would allow the learners to study a predominant Fashion and Textiles focused course delivery.
6. Links to resources, websites and suggested searchable content that aids in the delivery of a lesson or series of lessons that are freely available online.

**Link to qualification**

<https://www.ocr.org.uk/qualifications/gcse/design-and-technology-j310-from-2017/>

See our range of planning and teaching resources on the link below (including delivery guides, project learning and teacher guides).

<https://www.ocr.org.uk/qualifications/gcse/design-and-technology-j310-from-2017/planning-and-teaching/>

See our range of assessment resources on the link below (including past paper, mark schemes, examiners’ reports, candidate exemplars/NEA guidance).

<https://www.ocr.org.uk/qualifications/cambridge-nationals/engineering-manufacture-level-1-2-award-certificate-j832-j842/assessment/>

# Years 9 and 10

# Term 1

**Year 9** (1-2 lessons per week)

For Year 9, term 1 will focus on the production of a prototype by following a series of NEA style lessons. These lessons have been signposted with ‘Year 9 lesson’ in the Focus column. The work completed during the term can focus on one chosen Non-Exam Assessment (NEA) contextual challenge, or a wider choice of contexts. Teachers can consider a shared class approach where all learners work on one context, which will simplify the preparation of resources and materials that support the work to be completed.

Learners will progress through the steps of an NEA, from identifying needs and wants, moving to a functional prototype, and at the end of the term students will finish with a lesson about new and emerging technology. This will encourage learners to use this new learning to develop a modified version of their prototype.

In order to facilitate the project, learners will only prototype using available easy to process materials (such as papers and boards, basics textiles and foams) rather than more resistant materials (such as timbers and metals). These materials, coupled with off the shelf parts (for example hinges, fastenings and clips) should allow learners to produce a functional prototype that can be critiqued by a user or the learner themselves. The teacher can use age appropriate versions of the ‘skipped’ lesson each week as inspiration or content for the homework that supports the lesson; either more structured and specific to the context chosen for the project, or encouraging learners to read and study around the subject with a level of independence.

**Year 10**

The autumn term focus is on covering a large section of the core content which will subsequently open up new avenues of learning into the deeper learning content. Learners will complete a light version of the NEA, mainly opening up the learners’ eyes to the opportunities within a contextual challenge, and how to take a broad approach to designing solutions, whilst focusing on the iterative modelling of a solution to a lower standard than a final GCSE NEA outcome. Teachers can choose to manufacture the learners’ outcome to increasing levels of quality if desired, or alternatively focus on broadening workshop skills and developing independence related to their deeper learning material area.

## Week 1 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| Introduction to the course, administration work (workbooks, folders, etc.)  **Explore**  Understand primary users and stakeholders related to existing products | 1.1aii Considerations for exploring a context should include: identifying primary user and wider stakeholder requirements | Teacher to deliver the course administration.  **Explore** Using a selection of common products, services and systems, challenge students to discuss and identify who the primary users are, and who are the connected and invested stakeholders. **Product examples** Games Console Bicycle Rucksack **Service examples** Pizza delivery app Repair store (watch)  Personalised garment ordering **System examples** A School National Rail A clothing recycling centre | Challenge learners to identify products, systems and services, and consider who the primary users are, and who the connected stakeholders are.  **Extension** Challenge learners to identify how the products, systems and services are specifically designed for the primary user, and where they are unsuccessful for the primary user or connected stakeholders. | 1.2ai. The impact of a solution on a user’s lifestyle. |
| Introduce the NEA contexts (previous year choices)  **Explore** Broadly consider a contextual challenge  *Year 9 lesson* | 1.1ai Considerations for exploring a context should include: where and how the system is used | Provide learners with 1, 2 or all 3 contextual challenges from the previous year. Set learners the task to discuss and map out the context they have chosen, to include:  Connected environments  Connected stakeholders  Existing solutions  Similar contexts & solutions.  Learners can create a plan of who they might interview to discuss the context in more detail. | Challenge the learners to identify 3 different stakeholders, 1 for each of the contexts. They can then interview one of these people asking them to discuss what the context means to them, what they know about it, and what issues and opportunities they feel exist. | 4.2ai. User centred design. |

## Week 2 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Explore** Handle, examine and discuss a range of existing solutions related to a context  *Year 9 lesson* | 2.1ai Explore existing designs, systems and products to identify features and methods. | Provide the learners with a choice of existing solutions that relate to or fit within the contextual challenges they have chosen to work on.  Set learners the task of working in groups to evaluate what the products they have in the handling collection aim to do, what features they share, what are their strengths and weaknesses, and how they could be improved. | Challenge learners to gather and find products that fit within the contextual challenge they are working on, and to document these with video discussions, photographs, and analysis of their features and strengths and weaknesses.  Rather than analyse the products themselves, video and interview users using the products for their application. | 1.1aii Considerations for exploring a context |
| **Design and Make Principles** Understand the terms usability, society, lifecycle, fashion / trends / taste / style, marketing and branding | 2.1ai Explore existing designs, systems and products to identify features and methods: ii. the influence of fashion, trends, taste and/or style  iii. the influence of marketing and branding  iv. the impact on society  v. the impact on usability  vi. the impact on the environment; life cycle assessment | Provide definitions for each of the terms ii to vi  Walk and talk through the analysis of a simple everyday product such as a hairdryer, outdoor jacket or kettle.   Ask learners to create critical statements for each of the terms.  E.g. The hairdryer has a recognisable brand (e.g. Dyson) that gives primary users confidence. The styling of the product matches the wider portfolio of Dyson products.   BBC Bitesize Link to Investigating: <https://www.bbc.co.uk/bitesize/guides/zfd9dxs/revision/5> | Challenge learners to create a revision flash card for each new term, with an example product that iconically represents the term.  E.g. Impact of Society - an electric car (e.g. Nissan Leaf) | 3.3 What wider implications can have an influence on the processes of designing and making - environmental initiatives, social and ethical awareness |

## Week 3 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Explore** Design a range of research tools that will help identify real opportunities within a contextual challenge  *Year 9 lesson* | 1.1 How can exploring the context a design solution is intended for inform decisions and outcomes - identifying primary user and wider stakeholder requirements | Introduce the following research tools:   * Observation * Data gathering * Five Whys interview (See attached) * One to one interview * Secondary Research   Learners can work in groups or individually and select the tool(s) they want to employ and design the specifics of the research tool to employ for their context exploration. | Challenge learners to try different methods of capturing the research evidence, through video, sound, photographs, written response, online survey, verbal, etc. | 1.1 How can exploring the context a design solution is intended for informing decisions and outcomes - how the investigation of social, cultural, moral and economic factors to identify opportunities and constraints can influence the design process. |
| **Technical Principles** Learn how to identify considerations of ergonomics and anthropometric data used in design | 1.2 Why is usability an important consideration when designing prototypes - ergonomic considerations and anthropometric data to support ease of use | Introduce the terms ‘ergonomics’ and ‘anthropometric data’.  **Practical approach:** Provide learners with blue foam and a 2D template for a games controller, teach basic hand tool use, and challenge learners to create a model that is both ergonomic and made to the anthropometric data of the class.  **Textiles Practical approach:** Provide learners with a range of basic fabrics and 2D templates for a simple garment like a pair of gloves or hat, and challenge learners to create a mockup that is made both to be ergonomic and using anthropometric data of the class.  **Theoretical approach:** Provide learners with products (images or real products) that are marketed as ‘ergonomic’ (e.g. keyboard, chair, etc.). Set learners task to identify the features.  Provide learners with a table of anthropometric data (see practice GCSE exam paper 2018, Q2a Fig. 3, or alternatively refer to the appendices in the OCR A Level specification) and challenge learners to identify the appropriate dimension ranges for a series of existing products, e.g. chair, telescope, ladder, doorway, etc.) | Challenge learners to create a revision flash card for ‘ergonomics’ and ‘anthropometric data’, with an example product that iconically represents the term. | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? i. wastage ii. addition. 7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? ii. templates, jigs and/or patterns. |

## Week 4 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Explore** Develop a wide range of requirements, both wants and needs  *Year 9 lesson* | 1.1 How can exploring the context a design solution is intended for inform decisions and outcomes - identifying primary user and wider stakeholder requirements | Use the ‘**cluster down**’ (See attached) technique of analysing any completed research tools and turning each into a series of words which represent the themes of the findings. Challenge learners to create a post-it note for each research tool, representing each tool findings as a single sketch.  Collate these together on a page and identify the main themes and needs.  Turn these into specific wants and needs for the user and wider stakeholders. | Challenge learners to complete additional research tools that extend beyond the initial findings, such as delving deeper into some outcomes, creating new tools to gather information, or secondary research and physical product handling (handling collection creation and analysis). | 2.1 What are the opportunities and constraints that influence design and making requirements? |
| **Create**  Explore a range of suitable sketching and modelling approaches for communicating initial concepts | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? A. clear 2D and 3D sketches with notes; sketch modelling | Introduce the key sketching skills expected of learners when creating new ideas. Teach skills where learners need to present broad ideas and concepts without going into specifics about the design solutions.  E.g. use tracing paper to sketch over context-based photographs of users and encourage learners to develop ‘concepts’ first before ‘design ideas.  BBC Bitesize link to Designing: <https://www.bbc.co.uk/bitesize/guides/zrx7xfr/revision/4> | Challenge learners to rough out sketch models of their ideas in craft materials. E.g. making scales, wearable and functioning / non-functioning sketch models to give to a user or stakeholder to explore and discuss as part of ongoing ‘User Centred Design’. | 4.2ai. User centred design.  5.1 What are the main categories of materials available to designers when developing design solutions? |

## Week 5 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Explore/Create** Analyse and speculate about the environment the solution will work in, in order to establish potential materials and required characteristic properties.  *Year 9 lesson* | 5.1 What are the main categories of materials available to designers when developing design solutions?  5.2 The characteristic properties of the main categories of materials and why this makes them suitable for different uses. | Learners can be given or can create a bank of photographs of the physical environment/people in poses within and around which their solutions are going to be used, within the contextual challenge (e.g. Physical Recreation might result in images of a sports hall, sports field, or swimming pool, and people competing in sport, both whole body and parts of the body).  Learners use their textbooks to explore the material areas, specifically the tables of materials for each group, and identify which materials are commonly used in ‘similar’ contextual applications.  Learners are challenged to note down the key material properties.  Learners can use the BBC Bitesize Website to support this task. Paper & Board: <https://www.bbc.co.uk/bitesize/guides/zbqdqhv/revision/1>  Timbers: <https://www.bbc.co.uk/bitesize/guides/zktmtv4/revision/1>  Metals: <https://www.bbc.co.uk/bitesize/guides/zm3f3k7/revision/1>  Polymers: <https://www.bbc.co.uk/bitesize/guides/zf848mn/revision/1>  Fibres & Fabrics: <https://www.bbc.co.uk/bitesize/guides/zmbyb82/revision/1>  Design Engineering: [https://www.bbc.co.uk/bitesize/guides/zh4g4qt/revision/1](https://www.bbc.co.uk/bitesize/guides/zh4g4qt/revision/1%20)  To extend, learners should try to identify alternative materials that have the same or similar properties that might offer new opportunities. | Challenge learners to identify smart or modern materials that provide new opportunities for the solution to perform differently or surprisingly using the new properties and characteristics.  Learners could try to establish how they would meet some of their requirements through the introduction of smart or modern materials. | 5.1 What are the main categories of materials available to designers when developing design solutions?  f. Awareness of developments in modern and smart materials. |
| **Technical Principles** Learn about the sourcing and origins of materials in relation to global sustainable development | 3.3 What wider implications can have an influence on the processes of designing and making?  5.3 Why is it important to understand the sources of origins of materials and/or system components? | Introduce case study and fact sheet resources about each of the material areas that challenge learners to question:   * The source of materials * The carbon footprint of transportation * The processes from raw into usable materials * The working conditions of workers in developing countries * Issues associated with mining, harvesting, manufacture and transport of materials they are considering using.   This task is ideally suited as an exploration lesson where less information is provided at the start, and learners split into teams who explore one or two specific materials and then subsequently present back to the class. | Challenge learners to reflect on the information they gather about materials and their origins and use the information to change the materials they intend to use, or potentially create new requirements that will meet user and stakeholders needs and wants. | 1.1 How can exploring the context a design solution is intended for inform decisions and outcomes - identifying primary user and wider stakeholder requirements  S2a. Selection of materials and components based on ethical factors, taking into consideration the ecological and social footprint of materials. |

## Week 6 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and Make Principles** Develop a range of conceptual solutions that work within the contextual challenge  *Year 9 lesson* | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Introduce the time period for learners to develop sketched solutions (refer to the sketch/trace approach).  Set learners a task to develop quick concepts, build on previous ideas, and both adapt existing solutions and explore new opportunities.  Encourage learners to work in pairs or to circulate around their group to gain feedback (use Post-it’s to record this), that might guide or enhance the concepts each time they are discussed. Set a requirement to discuss each idea with 3 of their peers and use the ‘feedback’ to develop or adapt their ideas.  Consider using SCAMPER as a tool to help not only develop new ideas but adapt existing ideas.  See link: <https://www.mindtools.com/pages/article/newCT_02.htm>  <https://www.interaction-design.org/literature/article/learn-how-to-use-the-best-ideation-methods-scamper>  <https://www.designorate.com/a-guide-to-the-scamper-technique-for-creative-thinking/> | By challenging learners to produce a large breadth of solutions, they then have an opportunity to:  1. Rank the conceptual ideas on different merits  2. Ask users and stakeholders to compare and eliminate ideas  3. Look to critique ideas against the requirements list  4. Explore an interview approach with a user to establish ideas and challenge the user to sketch (or sketch over existing sketches) new improved solutions. | 4.2ai. User centred design. |
| **Technical Principles** Learn about the stock forms of materials designated for users and manufacturers | 5.4 Awareness of commonly available forms and standard units of measurement of specific and/or system components when calculating cost and quantities. | Provide learners with supplier catalogues (or use the internet for research). Learners produce a spider diagram of five material areas (timber, polymer, metal, paper/card, textiles), and use sketches and notes to show the different stock forms available to a user (high street buyer).  Learners can use colour coding to identify stock forms that are also/better suited to manufacturers (pellets for polymers), and forms that are becoming more ‘high street’ friendly (filament for 3D printers).  Learners can do the task initially from what they know, then from what they can find out, and stock forms can be linked to a workshop or storage tour of the department. | In order to explore costings, learners could be challenged to use pricing from suppliers to cost past GCSE outcomes or KS3 projects. Data sheets specific to each of the school’s projects could be used as a tool to develop initial awareness of costings.  Extension: challenge learners to look at buying in larger quantities/volume and the benefits of scales of economy. | 8.1b. How can cost and availability of specific materials and/or system components affects their selection when designing?  S1b. Calculation of quantities, measurements of materials and selection of components |

## Week 7 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| Design and Make Principles Develop a range of conceptual solutions that work within the contextual challenge (cont.)  *Year 9 lesson* | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Set learners a task to continue to develop quick concepts, build on previous ideas, and adapt existing solutions / explore new opportunities.  To further the progress of design, encourage learners to conduct additional secondary and primary research as issues from feedback are identified. Challenge learners to document their research (e.g. saving website links, screenshots, photo evidence, etc.) or to use video/sound to record the feedback discussion.  Learners should review their needs and wants across the requirements list and adapt these as new discoveries are made. | Challenge learners to begin to consider applying their materials knowledge to their ideas, annotating them as ideas progress.  Learners could have access to material samples to support the discussion of concepts with users and stakeholders. | 4.2ai. user centred design.  5.1 What are the main categories of materials available to designers when developing design solutions? |
| **Technical Principles**  Review the use of CAD/CAM in the production of prototypes | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Discuss the value of CAD/CAM using example outcomes and set learners the task of mapping out the strengths and weaknesses of CAD, then of CAM. Link to specific material areas depending on their in-depth learning topics.  Provide time and support to learn / reinforce a CAD package available in the department (2D or 3D), depending on available CAM. Use tutorial videos, handouts, demonstration on the board, or peer teaching to reinforce or teach specific skills, to help learners apply CAD/CAM to the production of their prototypes.  Here is a link to some FREE CAD packages you may like to consider. <https://www.ocr.org.uk/Images/583570-guide-to-free-cad.pdf>  Provide guidance on how to document iteration through CAD (saving multiple versions, screenshot stages, annotation of images, etc.) | Use tutorial videos to support extended learning and independent learning of CAD (e.g. Youtube: Product Design Online).  Challenge learners to produce printed examples of independent CAD work (a Lego brick, a rendering, a technical drawing, iteration work, etc.). | 7.5 How do processes vary when manufacturing products to different scales of production a. scales of production b. awareness of manufacturing processes used for larger scales of production. |

## Week 8 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Develop iterative prototyping skills in order to progress towards a design solution  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide learners with a prototyping trolley of materials ranging from cards/papers, easy to work with timbers, thin / flexible polymers including transparent material, expanded foams, off the shelf parts (hinges, split pins, clips, fasteners, nuts/bolts, etc.), a range of adhesives (mitre, hot melt, glue stick, PVA), easy to manipulate metals (wires), and a range of electronic components (LED’s, battery snaps, bulbs, 3v motors, etc.).  **Textiles Approach:** Provide learners with a prototyping trolley of materials with distinctly different performance properties, from rigid to stretchable fabrics, materials that can be combined to create composites, fabrics that can be molded or dyed, and the resources to change the appearance of materials, along with fastenings, embellishments, along with e-textiles for inclusion of basic electronics.  Provide learners with guidance on safe working practice relevant to their skills and experience.  Give learners time to explore and develop the modelling and iteration of sketch models and prototypes.  Encourage learners to move from simple solutions with less functional performance through to prototypes that perform closer and closer to the real outcome, changing one aspect of the solution each time.  Where possible provide the opportunity to include CAD/CAM if viable.  Consider providing a growing focus on accuracy and quality assurance as the iteration process moves forward.  BBC Bitesize Link to Making: <https://www.bbc.co.uk/bitesize/guides/z6cbcj6/revision/1> | Challenge learners to integrate CAD/CAM into the process of iteration, including the use of ‘quick’ processes such as laser cutting and vinyl cutting, through to more time-consuming processes including 3D printing, CNC routing, etc.. | 7.5 How do processes vary when manufacturing products to different scales of production?  7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? |
| **Technical Principles** Use digital tools and media to capture design iterations, decisions and discussions. | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Discuss previous work by students or exemplar work, and create questioning around the following points:   * What needs to be captured during iteration? * What are the best methods to capture evidence? * Where are digital images useful? * Where are videos more appropriate? * How could you use sketches and audio?   Set learners the task of practicing capturing information based around a model making task (e.g. could use a construction kit that can be changed and developed over time) | Challenge learners to create folders, online accounts or other tools that will help store, save, organise and play a range of media through an NEA document. | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party?  4.2 How do designers source information and thinking when problem solving? |

## Week 9 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Develop iterative prototyping skills in order to progress towards a design solution (Cont.2)  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide a second week of iterative model making to continue the process. Use this week to embed the practice of capturing iterative decision making and reinforce the organisation of this journey into documented NEA style work.  Use time within the lesson for peer assessment or reflection of the work produced, working in pairs or groups. This could involve a pre-agreed set of questions to formulate a discussion about the prototyping to date or encourage learners to form focus groups and both handle and talk about the prototyping that has been achieved. | Challenge learners to document the reflection time on their prototypes using the digital methods of the previous week. Use time live evidence such as video and audio to document rich discussion and try to challenge learners to establish how their outcomes perform against the requirements list. | 7.5 How do processes vary when manufacturing products to different scales of production?  7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? |
| **Technical Principles** Handle and explore the applications of a range of standard components, off the shelf parts and stock forms | 5.4 Why is it important to know the different available forms of specific materials and/or systems components? | Provide learners with a range of standard components, and challenge them to consider how they are used, with which materials, and what tools might be needed to fit them.  Discuss the components, and group them into material appropriate areas. Include discussion about components which might work across multiple material areas such as hinges and rivets and draw attention to how they are different depending on the material they are joining. Encourage learners to use off the shelf components with uncommon materials such as zippers with polymers or thin timbers.  Provide learners with large cards to mount each standard component, and sketch their applications, annotating the important information about their application. | There is opportunity here for learners to consider the issues associated with using standard components with materials not suited to them (e.g. a hinge with screw holes being joined to a sheet polymer).  Learners could redesign them for different applications   * design their own standard components * redesign components for different stock forms of materials * design in CAD and 3D print/laser cut new standard components | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing?  6.1 What gives a product structural integrity?  7.1 How can materials and processes be used to make iterative models? |

## Week 10 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Develop iterative prototyping skills in order to progress towards a design solution (Cont. 3)  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide a third week of iterative model making to continue the process. Use this week to focus on the reflection against the requirements list, adjusting these points accordingly, and ensuring that iterations as they are agreed, are done so led by the discussions (not by the learner), for a focused ‘user centred design’ approach.  Learners might at this stage be able to move some elements of their prototype into a high-quality material, working with accuracy and precision, and change both the material and process to make the prototype. Learners will want to do so by using the materials and standard component learning from previous weeks and continue to build upon previous iterations. | Learners could look at this point to take prototypes outside of the classroom and discuss their progress with outside users and wider stakeholders.  This is a great opportunity to reinforce skills of research, documenting decisions, using digital tools to record progress / milestones, and encourage real or more realistic testing of the prototypes in a contextual setting. | 7.5 How do processes vary when manufacturing products to different scales of production?  7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? |
| **Technical Principles** Taking a detailed look at how weaker materials and structures are strengthened for commercial applications | 6.1 What gives a product structural integrity? | Learners could start here by identifying methods they know that will make something stronger. This could be done using examples, e.g. make a material thicker, laminate a material to another, bend or add stitching to a material.  Learners then discuss the strengths and weaknesses of the approach and decide if the negatives outweigh the positives.  Introduce a range of products, structures and images of context-based solutions, and discuss what has been used to strengthen the solution. Examples might include:   * Injection molded casings * Bridge structures * Laminated fabrics in weather resistant clothing * Layered garments with composite materials * Steel frames or load bearing static and mobile structures such as scaffolding or ladders.   Learners can apply terminology or definitions to each solution or scenario, sketch onto images, or use an investigation approach to decide what has been done and why. | Extension - provide learners with summary definitions and images of the approaches to improving structural integrity, and send learners out to find examples in  - their daily lives - school environment - nature  Learners could create image boards of what they find, and present back to the class. | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |

## Week 11 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Develop iterative prototyping skills in order to progress towards a design solution (Cont. 4(final))  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | In the final week of iteration, learners are challenged to reflect on their iterative modelling and prototyping, and decide:   * What remains to be met in order for the solution to succeed * What has been met from the requirements list * Has the process of iteration been conducted with a clear consideration of the user’s views, preferences and feedback? * What has not been met and why? * What material and process choices would take the prototype to a final testable outcome?   The learner will require a functional, testable, presentation ready prototype that can either   * Perform the function full size * Perform the function or part of the function to scale * Prove a concept idea will work with supporting material / technical evidence * Meets the users’ needs and wants.   Learners should aim to ensure the prototype can be demonstrated to others for feedback. | Challenge learners to consider the use of digital testing, simulation and CAD/virtual modelling to support the subsequent presentation of the solution to an audience.  Learners could use finite element analysis tools to test the model in a virtual environment. This could include stress analysis, reinforcing or creating assembled structures (including standard fixings), injection moulding simulation via liquid flow into a cavity, and draft analysis, as well as typical rendering techniques. | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas?  7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? |
| **Technical Principles** Learn how to cost a product accurately, and how to cost iterative model making | 8.1 How can cost and availability of specific materials and/or system components affect their selection when designingg? | Providing learners with a data sheet, set out the task of completing a retrospective materials order form that includes all the materials used for 1. The final prototype 2. The iterative prototype models leading to the final solution  Learners then must aim to accurately calculate the cost of materials line by line. Encourage learners to show working out on a separate sheet for each material and part they consider.  Use exam style questions to prove this skill has been met, through the provision of exam questions relating to finished products (see 2018 practice paper question Q2 - desk example as a framework for creating a series of questions). | Challenge learners to map out the costs that go beyond materials. This could be guided to include questions such as:   * What is the minimum wage? * How would salary affect costs? * What are overheads? * What consumables are required for prototype making? * How does scale of production affect cost?   Learners could develop a much broader understanding of manufacturing through the consideration of production costs beyond materials. | 5.2 What factors are important to consider when selecting appropriate materials and/or system  components when designing? c. other factors that influence the selection of materials and/or components.  5.3 Why is it important to understand the sources or origins of materials and/or system components? |

## Week 12 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Presentations** Present final solutions to an audience for critique  *Year 9 lesson* | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Learners take it in turns to present to their peers.  Learners should employ a prototype, presentation, and verbal explanation of the journey they have taken. It is important that learners can explain:   * Their interpretation of the contextual challenge * Their unique findings that led to the requirements * Their iterative design process * Their use of users and wider stakeholders * Milestones they reached * Their reflection of the process * My improvements they would take in the future. | Challenge learners to develop questions about the presentations they observe. Ask learners part of a discussion to collate the feedback, and then in groups decide ‘what makes an excellent presentation’.  Learners develop a set of rules or list of requirements that would help them present their ideas to a third party in the future. | 2.2 How do developments in Design and Technology influence design decisions and practice? |
| **Technical Principles** Consider how a new design solution will impact the lifestyle of users and wider stakeholders? | 1.2 Why is usability an important consideration when designing prototypes? | Learners explore through role play the lifecycle of their design solution. They can map out the life of the product from purchase to end of life, and role play scenarios in pairs with their solutions to hand.  The aim of the lesson is to test and consider more broadly the way in which solutions impact a lifestyle beyond their sole use. This can include powering or recharging, maintenance, or recycling at the end of its lifecycle.  Learners should document their reflections on the prototyped solution and explain what they feel is the key strengths and weaknesses of the concept. | Challenge learners to create ‘testing’ videos of their solution, conducted by their peers. Learners can go on to use these videos to support the modifications later.  Learners should write guidance for their product, and instruct others how to use it, before recording or documenting through video or observation the successes and failures of the testing. | 2.1 What are the opportunities and constraints that influence design and making requirements? |

## Week 13 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Assessment** Learn how markers and moderators will assess your NEA work, and critically reflect on your work (strengths and weaknesses) | Section 3f - Internal assessment of non-exam assessment (NEA), particularly the 5 strands of the Marking Criteria | Learners are walked and talked carefully through the assessment of their submitted work. This is a key opportunity for learners to have full, directed and specific detailed feedback that will help them establish their performance against marking criteria.  Provide exemplary work, feedback sheets, annotation and fully detailed specific targets that would help a learner to improve next time.  BBC Bitesize link to Evaluating: <https://www.bbc.co.uk/bitesize/guides/zfwkw6f/revision/1> | Learners should reflect carefully on feedback and ensure they understand how their work will be assessed in the future, and how to change their approach.  Learners could create new versions of work, add to work, change work, in order to apply their learning and prove their understanding. | NEA Evaluation |
| **Technical Principles** Consider how new and emerging technology might enhance design solutions, and what might future evolutions of a solution look like?  *Year 9 lesson NB This lesson will be used to teach the Year 9 class about new and emerging technology, that will be used to create a developed iteration of their final solution.* | 7.6 How do new and emerging technologies have an impact on production techniques and  systems? | Learners learn about different types of new and emerging technology and consider how it might impact product design and product evolution.  Providing a series of smart products (phosphorescent painted signage etc.), learners could consider where the solutions are used, what impact they have, the purpose of using smart materials, and the over impact a smart or modern material has on the products in contextual situations.  BBC Bitesize link to New & emerging technologies and Materials: <https://www.bbc.co.uk/bitesize/guides/zdtmtv4/revision/1>  <https://www.bbc.co.uk/bitesize/guides/zncbcj6/revision/1>  Learners could discuss these, design around these, or simply develop an understanding of their applications. | Learners could explore samples of smart materials and try to design them into existing products.  For example, using smart wire as a method of product disassembly, or heat responsive polymers to communicate danger in home products in the kitchen or bathroom.  For example, with Textiles, biomimicry shark skin fabric samples that perform different in water to regular polymer based composites and blended fabrics. | 5.1 What are the main categories of materials available to designers when developing design solutions? |

## Week 14 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Assessment** Set personal targets based on specific actions to be taken to improve NEA style work | N/A | Learners reflect on the project and create a series of directed targets for improving their NEA style work in the future.  A formulaic approach could be taken here to provide all learners with a document that interprets the Marking Criteria, and learners highlight what they need to do, and create a target sheet. This could link directly with perceived associated marks that would be gained from a new approach.  Learners should be directed relating to their assessed work and improved or ‘perfect’ versions could be created in this lesson. | (as previous) Learners should reflect carefully on feedback and ensure they understand how their work will be assessed in the future, and how to change their approach. Learners could create new versions of work, add to work, change work, in order to apply their learning and prove their understanding. | N/A |
| **Technical Principles** Propose modifications of a design solution in order to propose its future ongoing iteration  *Year 9 lesson NB learners use the learning from the previous lesson on new technology* | 2.2 How do developments in Design and Technology influence design decisions and practice? | Challenge learners to use information on smart and modern materials (textbook can be the source) to propose material changes to their final solution.  Consider how the physical design, its manufacture, and the outcome, might all change based on material changes.  Will this affect its use, the impact on the environment, or the lifestyle of the users and connected stakeholders?  Learners could create a list of ‘winners and losers’ in the modification of their solutions.  BBC Bitesize link relating to broader issues: <https://www.bbc.co.uk/bitesize/guides/zfd9dxs/revision/3> | Learners can look into the connected areas of society, usability, ethics, culture and environment, and reflect on how their solution might have broader impact on the world. | 2.1 What are the opportunities and constraints that influence design and making requirements?  5.1 What are the main categories of materials available to designers when developing design solutions? |

# Term 2

**Year 9** (1-2 lessons per week)

For year 9, term 2 will focus on learning the basics of CAD/CAM, in conjunction with making an outcome to a specific standard (level of tolerance). The lessons chosen for this year group are again signposted in the Focus column, and focus mainly on the manufacture of a chosen product (such as a solar powered product, handheld functional tool, performance garment, structural display box, mechanical device or similar outcome that could relate to a contextual challenge). The chosen product should include an element of digital design and digital manufacturing, whilst the consideration of a range of processes or materials would support learners in making material decisions in Year 10. Centres should design a focused practical outcome that can be made by their learners.

**Year 10**

The spring term focus is on developing key NEA skills, giving learners a breadth of material and process knowledge, and learners leading their own learning in areas of deeper learning course content. This term will see learners complete a focused make only project, where two periods per week challenge learners to spend time producing a replica product from technical drawings and stock materials, ideally in one of the materials being their deeper learning area. The second half of the term will challenge learners to focus on conceptual designing using CAD, applying less available materials and workshop technology to encourage more creative and limitless design solutions.

## Week 15 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Introduction to a manufacturing focused project (make only), and developing a broad understanding of materials  *Year 9 lesson* | 5.1 What are the main categories of materials available to designers when developing design solutions? | Commence with the introduction of a multi material product that learners will manufacture themselves. Learners could be provided with a technical drawing of the product which they need to analyse and establish:   * Cutting list * Production plan * Costings sheet * Quality checks * Jigs, templates, formers   Analysis could link to scales of production and the application of CAD/CAM for appropriate parts.  Product focus could be: GCSE outcomes from a previous cohort.  A custom designed product based on the learner’s/department’s material focus. For example:  **Timber focus:** a hanging wall unit with metal brackets and polymer storage features  **Polymer focus:** display unit with simple electronic lighting and card/paper packaged product (e.g. perfume)  **Metal focus:** mechanical hand tool or measuring device with timber display box and polymer foam inlay  **Paper/card focus:** corrugated card scaled furniture with polymer clips and textile handles  **Textiles focus:** tote bag with metal screen printing stencil and polymer tags/embellishments  **Design Engineering focus:** electronic circuit for pinball machine with timber construction and polymer fixings. | Challenge learners to develop a production plan using a digital or paper template. The learners should map out:   * The step order * The activity * The tools and equipment needed * Quality checks to be conducted * A blank column where learners can record progress, issues they have, and solutions they decide upon.   Learners can use this production plan as a checklist to guide their work in the workshop time and check off the steps as they go. | 7.3 How do designers and manufacturers ensure accuracy when making prototypes and products?  7.4 How do industry professionals use digital design tools when exploring and developing design ideas?  7.5 How do processes vary when manufacturing products to different scales of production? |
| **Technical Principles** Creating a visual map of the stock forms of materials, annotated with unit costs, quantities, weights and sizes | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing?  5.4 Why is it important to know the different available forms of specific materials and/or systems components? | Provide learners with an input of the stock forms of materials for the learners chosen material area.  (see exemplar department material stock list)  Set learners the task of drawing a visual map of the stock forms. Once complete, set the task of annotating key information that includes:   * The unit cost of a sheet, length, or by weight * The units a stock material is measured in * The industry standard weights and thicknesses that a stock form can be bought in   Practical approach  Provide learners with sample sizes of each stock form and set learners the task of preparing a physical/3D visual map of the stock forms, annotated with the same information. | Challenge learners to create a comparable map of stock forms for a second material area with matching annotation. |  |

## Week 16 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make principles** Mark out materials accurately using a range of techniques, tools and equipment, and minimising waste  *Year 9 lesson* | 7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? | Provide learners with stock materials (some may need to be pre-cut to manageable sizes for workshop use) for the product they are manufacturing. Using a process of demonstration, with learners making shorthand notes on the activities (which could be recorded on a production plan), learners observe, question, then apply the practical skills to mark out materials for cutting and preparing for the finished product. Examples might include:  **Timber:** marking out timber parts with hand tools  **Polymers:** marking out polymer parts without marking or scratching the materials  **Metals:** marking out metals using engineers blue and scribes  **Textiles/Paper/Card:** marking out sheet or roll materials using stencils, templates or using reference points.  Ensure learners are challenged to work to appropriate units of measurement and have the skills to quality check their outcomes.  Provide learners with appropriate knowledge about reference points (datums), and how to mark accurately.  Help learners to understand how marking accurately can impact on meeting a specific tolerance (waste allowance in marking out).  Set learners a challenge to tessellate, pattern or simple mark as many parts as possible from a larger sheet of material. | Challenge learners to convert units from metres to centimetres to millimetres.  Set learners a task to create a crib sheet of how to mark out on a specific material (a step by step checklist) | 7.2 How can materials be manipulated and joined in different ways in a workshop environment  when making final prototypes?  7.4 How do industry professionals use digital design tools when exploring and developing design ideas?  7.5 How do processes vary when manufacturing products to different scales of production? |
| **Design and make principles** Design and make a series of jigs, templates and patterns to support accurate batch production | 7.3 How do designers and manufacturers ensure accuracy when making prototypes and products? | Provide learners with a series of photos of parts or finished products, and challenge them to design for each:   * A jig, template or pattern that can be used to manufacture a batch * Propose appropriate CAD/CAM for specific parts * For textiles, learners can disassemble a finished garment or structural product into a 2D series of panels that would be stamped out. | Challenge learners to design in CAD a laser cut, 3D printed, or vinyl cut jig, template or pattern that would help manufacture a product in a batch. | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? |

## Week 17 -20 (3 lessons per week)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** The step by step introduction to wasting, addition and deforming/reforming processes to convert stock materials into parts for a product  *Year 9 lesson* | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Commence manufacturing by introducing an inquiry approach to a specific part, asking questions such as:   * What does the part look like before it is manipulated? * What amount of waste will be created? * Which features need to be accurate? * What could go wrong in the process of manufacturing the part? * What safety equipment might they employ to be safe?   Demonstrate the processes to the learners, before providing them time to practice and apply their learning to the production of the part(s). Learners might include the use of tools that support accuracy. | Challenge learners to change the material for the part, and consider how this will:   * Change the process * Change the outcome * Change how the part might perform * Change the potential functionality of the part   (delete or add to where appropriate) | 7.4 How do industry professionals use digital design tools when exploring and developing design Ideas?  b. Awareness of manufacturing processes used for larger scales of production |
| **Technical Principles** Create a revision card/summary document about a process for manipulating or joining a material in the workshop environment | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Provide learners with key words and terminology that is required in the description of a process, annotation of some equipment, or in the step by step of how to carry out the task.  Set learners the task of creating a revision sheet (physical, or digital) that could include videos (by link) or digital photos. Learners could create a format that can be repeated for multiple processes (e.g. the same layout for polymer injection moulding, extrusion, blow moulding, etc.).  For textiles this could be a range of fabric construction or fabric printing techniques. | Challenge learners to create exam style questions about the process(es) they have created revision materials for. | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |

## Week 21 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** The step by step introduction to wasting, addition and deforming/reforming processes to convert stock materials into parts for a product  (5 of 5 weeks) | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Reflective analysis lesson With learners completing the manufacture of a series of parts, introduce a review process of parts which could be in conjunction with teaching about quality control.  Introduce a series of checks and controls that learners can employ on their made parts/samples. Examples can include   * Tolerance of fit * Tolerance or measurements * Weighing * Visual inspection * Functional testing * Strength and performance testing (non-destructive)   Learners can document how accurate and well-made parts are in relation to expected quality for that age group. | Challenge learners to consider the quality control checks that would be appropriate on their product if it were mass produced. This could link to research into QA and QC in industry. | 7.4 How do industry professionals use digital design tools when exploring and developing design  Ideas?  b. Awareness of manufacturing processes used for larger scales of  production |
| **Technical Principles** Practice exam challenging learners to refer to stock materials, processes and marking out techniques in different product contexts | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing?  7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Set learners a test based on the learning that has been completed in the past 6 weeks. Learners could be given notice to use their created digital/physical revision tools, to use these and refine them.  Learners should complete a set of examination style questions that challenge them to demonstrate knowledge of why manufacturing decisions have been made in different contexts, with a range of materials (or from a specific deeper learning material area). | Challenge learners to write their own exam style questions in revision groups, and set a test to each other, either open book or traditional revision style exam. Learners could then edit, add to, or revise their revision materials to be more effective for the final examination. | 7.3 How do designers and manufacturers ensure accuracy when making prototypes and products?  7.4 How do industry professionals use digital design tools when exploring and developing design ideas?  7.5 How do processes vary when manufacturing products to different scales of production? |

## Week 22 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Introduce a range of smart, modern and composite materials and their applications in current products. | 5.1 What are the main categories of materials available to designers when developing design  solutions? | Practical (hands on) approach:  Providing a range of samples, products or combination, challenge learners to handle and identify the smart or modern feature of the product.  For example:   * Encourage learners to explore these products to identify the smart functions of the materials. * Provide products that will glow in the dark or respond to changes in heat   Link the products to the context of their use (e.g. phosphorescent materials in places such as signage in dark cinemas or on planes).  Set learners a task to map out the smart and modern materials into groups or across a spectrum of environmental changes (heat, light, electricity, pressure, etc.)  **This lesson could be delivered without physical products or samples, using textbook extracts.** | Set learners a research task to photograph, purchase, or simply identify products that have smart and modern materials. (e.g. learners might be able to identify bio polymers in plastic bags)  Challenge learners to explain why these materials are used in the contexts they have been found.  Which stakeholders do they benefit? | 1.1 How can exploring the context a design solution is intended for informing decisions and outcomes? |
| **Design and make Principles**  What past and present professionals and companies are leading in the application of new materials? | 2.1 What are the opportunities and constraints that influence design and making requirements? | Provide learners with a series of materials that are considered modern, innovative, unique and market leading (these might come from a range of material areas or from one specific category).  Learners are set a research challenge using the internet, to identify products that are employing these materials.  Learners should document:   * The product * The application * The USP of the product * The impact on stakeholders * The impact on society * The impact on usability   BBC Bitesize Link to Past and Present Designers: <https://www.bbc.co.uk/bitesize/guides/zfd9dxs/revision/4> | Challenge learners to handle and explore modern products, and to conduct a detailed product analysis. Set tasks that include:   * Aesthetic analysis * Testing the product (functional testing) * Consider the material choices * Consider the strengths and weaknesses of the solution * What other contexts could this solution be used in? | 2.2 How do developments in Design and Technology influence design decisions and practice? |
| **Technical Principles** Develop learners’ appreciation and application of CAD/CAM appropriate to the making project  *Year 9 lesson* | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Introduce learners to parts that are to be designed and manufactured using digital technology. This could include:   * laser cut parts * Plotter for fabric cutting * Vinyl cut graphics * Digital embroidery of a logo * 3D printed components * CNC routed circuit board * Digital stitching * Dye sublimation of graphics * CNC lathe metal fixings.   Learners observe a demonstration and consider the design constraints of the process (size, detail, material, etc.).  Learners then consider and design the part(s) for their manufactured product. | Challenge learners to write up the process from CAD application to CAM for the part they intend on making. This could link to a discussion of the pros and cons of CAD/CAM in the production of a product. | 2.2 How do developments in Design and Technology influence design decisions and practice? |

## Week 23 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Introduce a contextual challenge within which CAD outcomes with futuristic features can have an application | 1.1 How can exploring the context a design solution is intended for informing decisions and outcomes?  2.1 What are the opportunities and constraints that influence design and making requirements? | Provide learners with a contextual challenge (e.g. from the sample contexts 2018 **Context: Dining**  **Dining can be a wonderful social and cultural experience that does not only focus on the eating of food. Explore the ways design can enhance the experiences for any of the stakeholders involved.)**  Set learners task to formulate 2-3 research tools that will help them establish opportunities within the context. (Refer to the learning from the first term to decide which tools to design and apply in this new context).  Set learners the task to develop and employ these tools. | Set learners the task of conducting all of the research tools away from class and bringing the evidence of results into their next lesson to formulate and reflect on.  Tools could relate to a focus on modern, new and emerging technology. | 2.2 How do developments in Design and Technology influence design decisions and practice?  3.1 What are the impacts of new and emerging technologies when developing design solutions?  4.2 How do designers source information and thinking when problem solving? |

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| **Technical Principles** Develop learners application of CAD through a series of tutorials/demonstrations  Year 9 lesson NB the focus of this is the production of a part for the manufacture learners are engaged with, therefore more specific directed learning might need to take place. | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Take learners through a series of core skills for a CAD package.  E.g. 3D CAD   * Sketching in 2D for plotting * Extrusion/cut 2D shapes into 3D objects * Pattern features on a surface * Revolve a 2D shape around an axis * Shell out to hollow a solid shape * Fillet/chamfer the edge of a solid shape to curve or angle the edges * Create bodies that represent parts * Assemble part together into an assembly * Applying materials to parts to appear like real parts * Rendering a part or assembly to look photo realistic * Technical drawing production   2D CAD   * Line tools * Shape tools * Snap to grids * Patterns * Dimensioning * Layering * Vectoring graphics * Text * Grouping | Challenge learners to work through a series of appropriate modelling tutorials (see YouTube channels such as Product Design Online for Autodesk Fusion 360) and set learners independent learning tasks to create outcomes and evidence of practice and application. | 7.5 How do processes vary when manufacturing products to different scales of production?  b. Awareness of manufacturing processes used for larger scales of production |

## Week 24 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** What are the disruptive and emerging technologies that might influence conceptual and progressive product design | 7.6 How do new and emerging technologies have an impact on production techniques and systems? | Introduce learners to a range of new and emerging technologies such as AI, Robotics, 3D Printing, etc.  Set learners a task to identify a range of products that are currently used in the contextual challenge they are working to.  For example, for the dining context, learners might create an image board of:   * Serve ware * Cutlery * Table lighting * Cooking equipment * Specialist kit (fondue, tagine, etc.)   For Textiles:   * Napkins * Tea towels * Placemats * Linings * Heat Proof gloves etc.   Learners are then set the task to integrate new, smart and modern materials into these products to change their function, improve their usability, make the product suitable for different stakeholders, or evolve the product to its next iteration. | Challenge learners to start sketching and designing solutions and apply rendering and 2D/3D techniques to communicate ideas.  Learners would sketch with reference to how they would CAD the design, i.e. sketch and create the ‘sketches’ in a 3D package, and ‘extrude’ the shapes and forms, planning for fillets and cuts, amongst other features, or use line tools to create a 2D line based design. | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? |
| **Technical Principles** Using a range of videos and case studies to look at the lifecycle of products, and how they can be changed to evolve the product within its context. | 2.1 What are the opportunities and constraints that influence design and making requirements?  5.3 Why is it important to understand the sources or origins of materials and/or system components? | Using Autodesk Lifecycle tutorials (see YouTube channel), introduce the concept of life cycle analysis and life cycle thinking for product development. (case studies include a washing machine, bicycle, etc.).  Set learners a task of mapping out the life cycle of a product or products that are used in the context they are studying. For example, for the Dining context, consider a tea light heating serve unit, the life cycle of the product and the candles it consumes.  Challenge learners to propose:   * The impact of the product over its life * Ways to improve the life cycle * Materials used in the product * Production techniques * Methods to reduce its impact * Methods to close the life cycle into a loop   Learners could start to sketch and design ideas for improving a product's life cycle and challenge the impact of the product on the usability for the stakeholders. | Set learners the task to explore and read about the Circular Economy, its principles, the impact, companies involved, and to review the available videos and case studies which explain the ongoing and growing impact of this approach to the life cycle of products in the economy | 4.2 How do designers source information and thinking when problem solving?  ii. systems thinking. |
| **Technical Principles** Develop learners’ application of CAD  *Year 9 lesson* | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Provide learners time to develop their CAD part and transfer their file to the appropriate CAM output for manufacture.  Learners should document their CAD work in their workbooks, and analyse its design, annotating why it has been designed well.  Learners may wish to produce multiple versions of their designed part (time/material depending) | Challenge learners to reflect on why CAD was required in this instance. Learners could reflect on how a part would be produced before CAD/CAM and propose solutions for the batch or mass manufacture of that part. | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? |

## Week 25 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Develop a series of conceptual sketches and translate these into virtual models | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Provide learners with time to develop a range of requirements from their previous learning, before developing a series of sketches of conceptual ideas that will meet these.  Learners should approach the task by sketching with the process of CAD modelling in mind and could use appropriate annotation of CAD tools rather than features and functional aspects of the idea.  Learners should look at developing a simple range of concept sketches before creating CAD virtual models of their ideas. | Challenge learners to use their textbook to review and consider appropriate materials for the virtual model and apply these (3D CAD only). | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |
| **Technical Principles** How do designers move from designing in CAD to prototyping from CAD?  *Year 9 lesson* | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? | Demonstrate and teach the stages involved in taking CAD files into available CAM processes to produce parts.  This could include the production of laser cut parts, plotting fabrics, 3D printed outcomes, CNC machining and vinyl cutting or similar plotting process.  In 3D, link the teaching to the importance of virtual modelling in parts or bodies. | Challenge learners to export files for fabrication in CAM, and to manufacture parts that can be tested (using measuring tools such as calipers or a series of non-destructive and destructive testing) | 7.1 How can materials and processes be used to make iterative models?  7.5 How do processes vary when manufacturing products to different scales of production?  7.6 How do new and emerging technologies have an impact on production techniques and systems? |

## Week 26 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Develop a series of conceptual sketches and translate these into virtual models (continued) | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Provide learners with further time to develop concept sketches & CAD virtual models of their ideas. | Challenge learners to use their textbook to review and consider appropriate materials for the virtual model and apply these (3D CAD only). | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |
| **Design and make Principles** Move learners understanding of CAD and the application of tools to a greater level of application  *Year 9 lesson* | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Demonstrate and teach learners a deeper understanding of CAD and its applications, by exploring simulation of CAD models on screen.  Provide learners with a simple ‘cube’ tutorial, that includes assigning materials to the block.  Teach learners how to create a simulation (heat flow for injection moulding, stress analysis, air flow). Set parameters and materials.  Teach learners how to change materials or features of the cube (round edges, make a centre hole, etc.), and repeat the simulation process.  For Textiles, provide learners with a simple 2D layout of parts of a garment. Teach learners how to preview the cutting process to consider tessellation of parts to reduce production times.  Export results from the simulation and help learners to interpret the data to support the justification of changing design and make decisions in CAD. | Challenge learners to apply the simulation tools to their own CAD virtual models.  Set learners a task to iterate in CAD their design, to compare and contrast the outcomes and the impact of design iterations on the performance of a virtual concept design. | 8.1 How can cost and availability of specific materials and/or system components affect their  selection when designing? |

## Week 27 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Develop a series of conceptual sketches and translate these into virtual models  (cont. final lesson) | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Provide learners with further time to develop concept sketches & CAD virtual models of their ideas. | Challenge learners to use their textbook to review and consider appropriate materials for the virtual model and apply these (3D CAD only). | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |
| **Design and make principles** Present design outcomes for critique by peers | 4.1 How can design solutions be communicated to demonstrate their suitability to a third party? | Give learners a window to present their CAD work to the class, either through a formal presentation of show and tell of a virtual model.  Learners should propose how their design concept meets the requirements of the context, discuss how modern, smart and emerging technology has been applied to the concept, and how they could improve the concept following iteration.  Learners could link their presentation to the simulations conducted previously. | Challenge learners to propose a manufacturing plan for the prototype/concept, and what they might be able to achieve through a prototype, and what would not be feasible. | 1.1 How can exploring the context a design solution is intended for informing decisions and outcomes? |
| **Design and make principles** Complete the manufacture of a product  *Year 9 lesson* | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Learners finalise their manufactured product by combining hand-made and CAM manufactured parts to complete the outcome. This lesson might provide opportunity for reflection and testing with peers or provide a chance for learners to document and reflect on their learning in the workshop (either through an analysis write up or manufacturing diary with a column assigned for critique). | Challenge learners to propose improvements to the final outcome, either through changes to the processes or materials, or to the design itself. This could be communicated through sketching or CAD. | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |

# Term 3

**Year 9** (1-2 lessons per week)

For year 9, learners will complete all the lessons in blue column prior to the Year 10 NEA lessons, those in the purple column. These lessons will take the students through the development of a mechanical and electronic product, for example a pinball machine style device, a textile-based carry bag, or any of the suggested products listed below:

* A garment containing electronics and sensors
* A mechanical device to aid a person with a disability
* An electronic product using an off the shelf kit from a supplier such as Rapid Electronics, Kitronik or similar.
* A paper/card product display stand with functional elements
* An interactive display made from a combination of polymers, metals and timbers.

Each lesson in this term will encourage the learners to consider the functional elements that make the product interactive and provide some form of output that benefits the user. A focus on inclusive or exclusive design could help support learners in identifying relevant stakeholders for these suggested products.

**Year 10**

The summer term focus is on fine tuning specific skills learners need to excel in their NEA, reinforcing their independence, before then making a start on the real NEA in the second half of the term. The first six weeks focus on a small iterative challenge, taking a simple product and turning it into a developed solution that is fit for purpose for a new or existing user. In week seven, the learners will be introduced to the NEA context(s) for that year, released through the [qualification page](https://www.ocr.org.uk/qualifications/gcse/design-and-technology-j310-from-2017/assessment/) on the 1st of June, and commence their digital portfolio of evidence. This will see the learners complete four weeks of work on their submission, and complete 12 hours prior to the Summer break.

## Week 28 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** Where can movement be integrated into simple products?  *Year 9 lesson* | 6.3 How do we introduce controlled movement to products and systems? | Introduce a simple pinball machine product made from basic materials and no application of electronics or movement (see spec for list), beyond basic levers, e.g. this could be made from simple card or timber-based materials with limited functions.  For Textiles, introduce a simple carry bag (hold all, backpack, shopping bag or packed lunch bag), made from one or two fabrics and no application of electronics or smart materials, and limited functional considerations for storage or ergonomics.  Learners explore the product and consider what movement/storage could be introduced to change the product.  Challenge learners to sketch and plan in groups (or individual) how the product could change and improve.  Introduce learners to materials and electronics e.g. types of inputs for different forms of motion (rotary, linear, oscillating and reciprocating) and levers, or for textiles different functional features to support carrying a bag, enclosing a space, or combining materials. Electronics and e-textiles could consider similar system components. Set learners the task of sketching these so they are integrated into the design.  BBC Bitesize link to electronic systems and mechanical devices: <https://www.bbc.co.uk/bitesize/guides/zbj8jty/revision/1>  <https://www.bbc.co.uk/bitesize/guides/zdhxh39/revision/1> | Challenge learners to explore pinball machine games both real and digital, and to identify types of features and functions that could be made in a workshop environment. | 6.4 How do electronic systems provide functionality to products and processes? |
| **Technical Principles** How can mechanical devices add functional outcomes to a game?  Year 9 lesson | 6.3 How do we introduce controlled movement to products and systems? | Create ‘kits’ of laser cut or template (or hand cut) card, fabric or timber parts to model features like CAMs, gears, pulleys/belts and levers/linkages, or enclosures and carry features.  Set learners a task to create a visual display board of these working (use fixings such as split pins or nails, etc.).  Learners need to make an interactive display of these elements and describe the types of movement or design features they create. | With their display, learners are tasked with creating these features in their pinball machine game or carry bag. They could apply their learning to sketching or modelling these features as elements of the game/bag to enhance the challenge/use/enjoyment. | 6.4 How do electronic systems provide functionality to products and processes? |

## Week 29 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** What do inputs, processes and outputs look like in a range of simple and complex products?  Year 9 lesson | 6.4 How do electronic systems provide functionality to products and processes? | Set learners the task of exploring how inputs can trigger outputs.  Set learners the task of redesigning the pinball machine/carry bag using these mini electronic systems. This could include motors, switches, lights and similar, along with different sensors such as an LDR or similar.  Learners could mockup or prototype simple circuits (could use VEX or similar prototyping kit for e-textiles) and simulate specific functions of the product.  BBC Bitesize link to electronic systems and mechanical devices: <https://www.bbc.co.uk/bitesize/guides/zbj8jty/revision/1>  <https://www.bbc.co.uk/bitesize/guides/zdhxh39/revision/1> | To extend learners, they could disassemble or critique existing solutions including responsive products such as lights that come on at night automatically, or heat sensing/motion sensing products such as alarm cameras. Learners could explore these through disassembly, or analyse these from digital images. | 6.3 How do we introduce controlled movement to products and systems? |
| **Technical Principles** Explore a range of electronic components and test their functions in a circuit  Year 9 lesson | 6.4 How do electronic systems provide functionality to products and processes? | Provide learners with simple component diagrams and a bag of components. Set learners the task of matching them (provide a handout to document learning).  Introduce learners to simple circuit construction, which include sensing capabilities (could use a kit, sample kits from Rapid Electronics or Kitronik for example, or VEX EDR/IQ, Arduino, Microbit or similar).  Learners are set the task of prototyping simple circuits and building them into a cardboard pinball machine/simple fabric bag layout.  Learners could test out their circuits with peers or within their groups. |  | 5.4 Why is it important to know the different available forms of specific materials and/or systems components?  6.3 How do we introduce controlled movement to products and systems? |

## Week 30 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Technical Principles** How do we design with electronic components?  Year 9 lesson | 5.4 Why is it important to know the different available forms of specific materials and/or systems components? | Introduce learners to a CAD software package to design and simulate circuit design. (e.g. Circuit Wizard or similar).  Learners are tasked with creating a series of differing circuits, each with different components and outcomes. Learners should simulate the function of the circuit and propose (or explore) what has gone wrong in each instance.  This task might be best driven with example circuits, which could be dismantled and modified to test how they change their output. | Learners could design simple circuits for a range of products include portable fans, music players, random number generators, moving into more complex circuits such as temperature sensors and pedometers. | 7.4 How do industry professionals use digital design tools when exploring and developing design ideas? |
| **Technical Principles** How could the construction of a product be strengthened for different uses?  *Year 9 lesson* | 6.1 What gives a product structural integrity? | Learners are set the challenge of taking a flat pinball game/template of a carry bag and making it into a structurally strong and performing product, using off the shelf parts and materials.  Learners could be set this as a practical task, or as a design only task, or a combination. This would easily also be modelled in CAD. | Learners could challenge themselves to make and test their ideas in a contextual situation (e.g. take the product home and bring it back, to test its strength).  Learners could link their learning to material properties and propose better materials and processes to support the performance of the product. | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? |

## Week 31 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Prototype an improved product, bringing together different learning and knowledge  (continued for 2nd lesson)  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide learners with craft and prototyping materials to redesign and sketch model a new pinball machine/carry bag. This could be in basic card, fabric or timber sheet, or through 2D CAD and laser cutting.  Learners are tasked with integrating a circuit and motion into the product. This could include:   * A circuit to fire the ball up the game, and lights or sounds that trigger with impact/ triggers to make the bag react to it being opened or closed * A series of sensors that trigger movement in game components/that trigger the bag to change when it senses changes in the environment * The redesign of components such as targets/goals, bag panels and openings, that could respond when touched etc. | Learners could use CAD/CAM to prototype and manufacture laser cut and 3D printed parts that would enhance the product outcome. | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? |
| **Technical Principles** Develop a programming approach for a piece of accessible software  *Year 9 lesson* | 6.4 How do electronic systems provide functionality to products and processes? | Introduce a programming language (Microbit online, Mblock, RobotC, Arduino, Modkit, etc.)  Teach learners the basic building blocks that form the code. Learners would work to: - existing files they analyse to identify the function - make their own programs to achieve an outcome - create programs for short control tasks or to create movement in a motor or generate light/sound. | Learners would challenge their learning by extending their work into designing programming a physical or virtual robot (kit based on online simulation such as VEXWorld or similar) | 6.3 How do we introduce controlled movement to products and systems? |

## Week 32 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Prototype an improved product, bringing together different learning and knowledge  (continued for 3rd lesson)  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide learners with craft and prototyping materials to redesign and sketch model a new pinball machine. This could be in basic card or timber sheet, or through 2D CAD and laser cutting.  Learners are tasked with integrating a circuit and motion into the product. This could include:   * A circuit to fire the ball up the game and lights or sounds that respond to being touched or open/closed in the bag. * A series of sensors that trigger movement in game components/bag features * The redesign of components such as targets or goals that could respond when hit, or in the bag where panels are touched or interacted with. | Learners could use CAD/CAM to prototype and manufacture laser cut and 3D printed parts that would enhance the product outcome. | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? |
| **Technical Principles** Learn how to solder and construct PCB and wire only circuits  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Learners are given a demonstration including Health and Safety, for working with heated tools and equipment.  Learners follow instructions on how to solder circuits, either kit based or using wires.  Learners write up the process and step by step, including any quality checks they might consider. | Challenge learners to consider how soldering is similar and different to alternative methods of circuit construction (surface mounting, mechanical clips, etc.).  Learners could compare and contrast the techniques and their benefits. | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? |

## Week 33 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** | **Linked areas** |
| **Design and make Principles** Prototype an improved product, bringing together different learning and knowledge  (continued for 4th lesson)  *Year 9 lesson* | 7.1 How can materials and processes be used to make iterative models? | Provide learners with craft and prototyping materials to redesign and sketch model a new pinball machine/carry bag. This could be in basic card, fabrics or timber sheets, or through 2D CAD and laser cutting.  Learners are tasked with integrating a circuit and motion into the product. This could include:   * A circuit to fire the ball up the game, and lights or sounds that trigger the carry bag in some way * A series of sensors that trigger movement in game components or in the bag when it opens or closes * The redesign of components such as targets or goals that could respond when hit, or in the bag when panels and areas are touched. | Learners could use CAD/CAM to prototype and manufacture laser cut and 3D printed parts that would enhance the product outcome. | 7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? |
| **End of Year 9/10 review**  *Year 9 lesson* | All | Learners reflect on the academic year and identify personal strengths and areas for improvement. This could be done as:   1. A RAG document vs the specification (see example document) 2. An end of year test 3. A revision materials task 4. A verbal discussion or class discussion 5. A reflection task of work in the learners’ folder, etc.   Learners review their personal strengths and identify what they need to learn during the NEA work, or after in preparation for the end of course examination (or mock examination middle of year 11). | Learners could create revision tools based on their weaker areas of knowledge and produce revision flash cards, practice questions, source videos or example case studies, to revise from and improve their weaknesses. | N/A |

## Week 34 (3 lessons) 3 hours

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| **Focus** | **NEA Content Requirement** | **Learning Activities** | **Independent work/extension** |
| Introduction to the OCR NEA contextual challenges | **1. Identify requirements** Understand that all design and technological practice takes place within contexts that inform outcomes.  Learners should be able to identify and prioritise problems and opportunities that are relevant to their chosen context. These issues should be reflected on throughout their project. | Learners commence by analysing the context and mapping a range of stakeholders who would be connected to the contextual challenge.  Learners plan to interview a chosen stakeholder to explore in more depth the opportunities on offer.  Learners should focus on establishing a series of challenging design questions that they can then research to develop a list of wants/needs.  **Digital approach** Provide learners with the contextual challenge(s) as a PDF, from which they can copy and paste the text onto a slide in their NEA document. Ensure the document is set up to A3, and permissions/access arrangements are in place.  **Paper approach** Provide learners with A3 paper and a secure storage arrangement for all work. Learners will need to name and date their work as they progress. | Learners should meet and discuss with numerous stakeholders connected to the context.  Learners could map out products, ideas, issues and factors that relate to the specific context they have chosen to explore. This might involve directly referencing to the language and words of the contextual challenge. |
| **Design and make Principles** Design a range of tools that will support the identification of needs and wants | **1. Identify requirements** Investigate the needs, wants and interests of primary users and other stakeholders to identify and understand the requirements for designing, through collecting, analysing and presenting their findings from primary and secondary data. | Provide handout resources (or reminder resources) for a range of research tools the learners can now design for their contextual challenge exploration.   * Five whys interview * Observation * Secondary research * Data gathering * Survey   Learners will need to plan and write up these tools, conduct the research, and document their findings along with outcomes. These can form lists of needs and wants.  You may want to refer to some of our recommended enquiry techniques to ensure explorations with stakeholders result in meaningful information. <https://www.ocr.org.uk/Images/583574-guide-to-enquiry-techniques-for-students.pdf>  **Digital approach** Learners will want to include live links, screen shots, videos, sound bites or photos of the tools being employed.  **Paper approach** Learners will want to include photos or print out screenshots of the evidence, and save digital evidence to USB, or provide QR code links to live evidence from the portfolio. | Learners will need time to access stakeholders and conduct the tools. Learners should ensure they document and capture the research tasks live in the most efficient way. |

## Week 35 (3 lessons) 3 hours

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| **Focus** | **NEA Content Requirement** | **Learning Activities** | **Independent work/extension** |
| **Design and make Principles** Design a range of tools that will support the identification of needs and wants | **1. Identify requirements** Investigate the needs, wants and interests of primary users and other stakeholders to identify and understand the requirements for designing, through collecting, analysing and presenting their findings from primary and secondary data. | Provide learners time to design and employ the research tools for their contextual challenge exploration.   * Five whys interview * Observation * Secondary research * Data gathering * Survey   Learners will need to plan and write up these tools, conduct the research, and document their findings along with outcomes. These can form lists of needs and wants.  You may want to refer to some of our recommended enquiry techniques to ensure explorations with stakeholders result in meaningful information. <https://www.ocr.org.uk/Images/583574-guide-to-enquiry-techniques-for-students.pdf>  **Digital approach** Learners will want to include live links, screen shots, videos, sound bites or photos of the tools being employed.  **Paper approach** Learners will want to include photos or print out screenshots of the evidence, and save digital evidence to USB, or provide QR code links to live evidence from the portfolio. | Learners will need time to access stakeholders and conduct the tools. Learners should ensure they document and capture the research tasks live in the most efficient way. |
| **Design and make Principles** Handle and explore a range of existing products from the context in order to establish needs and wants | **2. Learning from existing products and practice** a. Investigate and analyse relevant existing products, understanding how they are used within their physical, organisational, social and/or cultural environments, using methods such as disassembly and systems thinking in order to make informed and reasoned decisions. | Provide learners with a handling collection that relates to their contextual challenge. Learners should be able to select from a large number of products, and take these away to test, critique and evaluate.  Handling collections could be generated from learners each bringing in products or provided by the teacher.  By providing learners with time to explore the products, learners should refer to previous experience of product analysis, and document their critique in a number of ways.   * Ask a user to use the product(s) and observe them doing this, asking questions * Handle and analyse the physical functions and aesthetics of the product through photographs and using subject knowledge * Disassemble products to explore how they work, their construction joining techniques, and materials. * Take products through all of the above in a suitable order that allows for maximum learning from the product.   BBC Bitesize link to Exploring Existing Designs: <https://www.bbc.co.uk/bitesize/guides/zfd9dxs/revision/5> | Learners should look to buy, find or gather products that could form handling collections within the contextual challenge.  Learners could: - gather the products themselves - collect products from the stakeholders - use detailed online disassembly and customer use videos (where purchase or access is not possible) |

## Week 36 (3 lessons) 3 hours

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| **Focus** | **NEA Content Requirement** | **Learning Activities** | **Independent work/extension** |
| **Design and make Principles** Design a range of tools that will support the identification of needs and wants | **1. Identify requirements** Investigate the needs, wants and interests of primary users and other stakeholders to identify and understand the requirements for designing, through collecting, analysing and presenting their findings from primary and secondary data. | Provide learners time to design and employ the research tools for their contextual challenge exploration.   * Five whys interview * Observation * Secondary research * Data gathering * Survey   Learners will need to plan and write up these tools, conduct the research, and document their findings along with outcomes. These can form lists of needs and wants.  You may want to refer to some of our recommended enquiry techniques to ensure explorations with stakeholders result in meaningful information. <https://www.ocr.org.uk/Images/583574-guide-to-enquiry-techniques-for-students.pdf>  **Digital approach** Learners will want to include live links, screen shots, videos, sound bites or photos of the tools being employed.  **Paper approach** Learners will want to include photos or print out screenshots of the evidence, and save digital evidence to USB, or provide QR code links to live evidence from the portfolio. | Learners will need time to access stakeholders and conduct the tools. Learners should ensure they document and capture the research tasks live in the most efficient way. |
| **Design and make Principles** Handle and explore a range of existing products from a similar context, in order to establish needs and wants | **2. Learning from existing products and practice** Investigate and analyse the wider work of professionals and companies in order to stimulate their own design thinking. | Provide learners with alternative handling collections from comparable or alternative contexts. For example, provide a collection of products that pop up or are self-assembly for a ‘physical recreation’ context, will help learners identify functions and features of successful products that all share a pop up feature, but do not apply in a sports context (e.g. ironing board, clothes hanger, etc.) | Learners should be able to gather and test groups of products from alternative contexts to challenge their thinking.  Learners could explore existing handling collections within the department such as smart materials or storage, etc., and use these to analyse. |

## Week 37 (3 lessons) 3 hours

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| **Focus** | **NEA Content Requirement** | **Learning Activities** | **Independent work/extension** |
| **Design and make Principles** Design a range of tools that will support the identification of needs and wants | **1. Identify requirements** Investigate the needs, wants and interests of primary users and other stakeholders to identify and understand the requirements for designing, through collecting, analysing and presenting their findings from primary and secondary data. | Provide learners time to design and employ the research tools for their contextual challenge exploration.   * Five whys interview * Observation * Secondary research * Data gathering * Survey   Learners will need to plan and write up these tools, conduct the research, and document their findings along with outcomes. These can form lists of needs and wants.  You may want to refer to some of our recommended enquiry techniques to ensure explorations with stakeholders result in meaningful information. <https://www.ocr.org.uk/Images/583574-guide-to-enquiry-techniques-for-students.pdf>  **Digital approach** Learners will want to include live links, screen shots, videos, sound bites or photos of the tools being employed.  **Paper approach** Learners will want to include photos or print out screenshots of the evidence, and save digital evidence to USB, or provide QR code links to live evidence from the portfolio. | Learners will need time to access stakeholders and conduct the tools. Learners should ensure they document and capture the research tasks live in the most efficient way. |
| **Design and make Principles** Write a detailed design brief based on the established and discovered needs and wants to stakeholders | **1. Identify requirements** Be able to write a design brief in response to a contextual challenge that considers the stakeholders that could have an interest in the potential outcome. | Learners will need to review their research around the contextual challenge and prepare a design brief based on their findings to date.  A method for delivery this could follow the following format; **User** (specific based on the research) **Need**s to (action verbs related to empathy with the user) **because** ‘Unique discoveries about the user(x) made through research (could relate to the users motivations). I am going to design a product that helps User(x) to achieve stated Needs.’  Learners could discuss their brief and research findings with a peer and adapt and edit the content to ensure it is sufficiently broad and challenging. | Learners could present their design brief to a stakeholder and discuss potential avenues for exploration.  Learners should document this approach and use the outcomes as part of their NEA submission, crediting contributions. |

# YEAR 11

# Term 1

The autumn term focus is on pulling together the research conducted, in a process called clustering down, which then provides the opportunity for learners to write requirements, develop concept ideas, and progress these from rough sketches and sketch models through to working prototypes. The process of prototyping through to final prototype is entirely flexible within the school but should feel seamless from early ideation to eventually making a final working and testable prototype.

## Week 1 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Develop a growing list of requirements focused on the wants and needs of stakeholders | **4. Design thinking and communication** Demonstrate an ability to identify and formulate appropriate requirement lists and specifications, reflecting on their own investigations and considering stakeholder needs, | Review the definitions of a Need and a Want and set learners the task of developing a broad list of needs and wants sourced (and referenced from) the research conducted.  Learners will need to add to this requirements list as the NEA progresses, but should find opportunity independently to present and discuss the requirements with relevant stakeholder(s).  Learners should document the requirements in table format, so that they can be RAG’d and/or ranked by importance.  Learners may wish to start concept sketching ideas using the requirements list, initially in thumbnail and small, or directly to larger format such as 1 sketched idea per A4 paper (suitable for scanning into an electronic portfolio and shrinking down to raise the quality of line work).  Learners will want to reduce the full requirements list down to 6 primary user needs (PUNs) which represent the most important requirements to be met, for the outcome to be successful. These should be agreed with the primary user. | Learners should look to continue sourcing and analysing existing products, including products that both relate or come from a comparable context.  Learners could buy and disassemble products and link their research to subject based knowledge such as materials, processes and techniques. |
| **Design and Make Principles** Create a range of 10 concept sketches that respond to the design brief, meet the requirements (on the whole), and fit within the contextual challenge | **4. Design thinking and communication** Apply techniques in order to communicate and record design ideas suitable to the stage of development in order to justify their own thinking and present their thinking and intentions to a third party. | Provide learners with time to sketch concept ideas, setting a target of 10. Each idea should be uniquely able to meet the differing requirements of the stakeholders.  Learners might want to try the following approaches   * Scamper * Change the function of existing products * Change the material, processes and techniques for each solution * Create high tech (unfeasible) and low tech (highly feasible) ideas, and progress forwards or backwards * Sketch over images of the context (i.e. photos of the context being design for) * Take ideas from an alternate context and apply them to this one * Sketch in groups (acknowledging who creates each idea/solution) * Sketch and re-sketch over basic product ideas to add and adapt their functionality.   Learners might want to try the following approach:   * Aim to sketch quickly, but in pencil or pen, suitable to scan the images in. * Do not worry about colour, unless it communicates important information about the idea. * Annotation should be included along with a short description, suitable so that a 3rd party can understand (and judge) the idea without the learner explaining it. | Learners should look to source or create images (photos) of the contextual challenge they are responding to. They can use these to sketch (trace) over their product ideas to show a contextual application of the concept. |

## Week 2 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Create a range of 10 concept sketches that respond to the design brief, meet the requirements (on the whole), and fit within the contextual challenge  (continued) | **4. Design thinking and communication** Apply techniques in order to communicate and record design ideas suitable to the stage of development in order to justify their own thinking and present their thinking and intentions to a third party | Provide learners with further time to sketch concept ideas, setting a target of 10. Each idea should be uniquely able to meet the differing requirements of the stakeholders.  Learners might want to try the following approach:   * Aim to sketch quickly, but in pencil or pen, suitable to scan the images in. * Do not worry about colour, unless it communicates important information about the idea. * Annotation should be included along with a short description, suitable so that a 3rd party can understand (and judge) the idea without the learner explaining it. | Learners should scan and document their sketches into their electronic portfolio or might consider scanning and reprinting smaller onto physical portfolios to support compressing the submission into 30 A3 slides/pages or less. |
| **Design and Make Principles** Complete a range of 10 concept sketches that respond to the design brief, meet the requirements (on the whole), and fit within the contextual challenge (continued) | **4. Design thinking and communication** Apply techniques in order to communicate and record design ideas suitable to the stage of development in order to justify their own thinking and present their thinking and intentions to a third party | Provide learners with a final time slot to sketch concept ideas, meeting a target of 10. Each idea should be uniquely able to meet the differing requirements of the stakeholders.  Once the learners have completed their designs, encourage grouped or paired work where learners take it in turns to critique and provide feedback on the ideas. Learners should present the concept, and their peers should write detailed feedback on post it notes. Learners can use this stage to critique their communication skills through sketching and adapt sketches to communicate ideas clearer. | Challenge learners to discuss their sketches with peers and encourage initial development and iteration onto sketches of the ideas. Learners could use post it notes to document the feedback and should date and acknowledge each piece of feedback to support a clear process of ideation. |

## Week 3 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Create a range of 10 concept sketches that respond to the design brief, meet the requirements (on the whole), and fit within the contextual challenge  (continued) | **4. Design thinking and communication** Apply techniques in order to communicate and record design ideas suitable to the stage of development in order to justify their own thinking and present their thinking and intentions to a third party | Provide learners with further time to sketch concept ideas, setting a target of 10. Each idea should be uniquely able to meet the differing requirements of the stakeholders. | Learners may want to extend their work into sketching and communicating ideas in context, sketching products or solutions being worn or used, or sketching stages of use such as step by steps that communicate the function of the concept over its use. |
| **Design and Make Principles** Plan the presentation of design ideas to the stakeholder(s) | **4. Design thinking and communication** Be able to use different design strategies and approaches such as collaboration, user-centred design and systems thinking when generating and developing innovative design ideas that avoid design fixation. | Learners should plan an interview style presentation of initial ideas to the stakeholder(s) which they will conduct and record.  Learners should refer to the requirements, the ideas, the contextual challenge and look to record the interview activity as a video or sound bite.  Learners will need to reflect on the feedback and use the comments to focus the iteration process going forward.  Learners could use time to compare their ideas against the requirements in a table format comparison, using a RAG system again. | Learners should conduct and document the presentation of initial concept ideas with a stakeholder, either through live evidence including video, or in photographs or similar.  Learners should reflect on the interview approach and summarise the findings.  Learners will want to reference to the PUNs again at this point to consider where the best progress might be made or where the most development is required. |

## Week 4 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Use appropriate materials, equipment and processes to create and develop a prototype from early concept through to functional outcome | **4. Design thinking and communication** Be able to design and develop at least one prototype that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics and marketability. | Learners should progress onto taking one (or more) of the concept designs that have been reviewed by the stakeholder(s) onto a physical model, through development stages, until a final physical and testable outcome has been achieved.  Learners could   * Start prototyping in quick and easy to work with materials such as paper, fabrics, foams, card and easy to cut materials, joined with glue gun or other easy to access techniques. Marker pen and stickers/printed graphics could be used to explore ergonomic and aesthetic aspects, as well as allow for simulating functional performance. * Learners would move into more durable resistant materials but work roughly without aesthetic consideration, ensuring the focus is on achieving a functional outcome first, before looking at non-essential aspects. * The use of CAD to model virtually ideas, and move from physical to virtual and back again, could allow learners to test out ideas both through simulation on the computer but also in real life. * A combination of the above that is combined to make sure the most appropriate approach is taken to develop and prove each progressing element of the concept.   Learners should   * Document their progress in photos, video or sound bites * Present prototypes to the stakeholder(s) regularly, ideally after each key iteration * Refer to the primary user needs (PUNs) regularly, not only in RAG form, but also in comments. * Conduct ongoing research including handling and disassembling products, finding and reading web articles and documents, testing out materials, and reference to these in the NEA slides. * Explain what was being attempted, how it went, what the outcome was, and what you will do next. | Challenge learners to produce a production plan for the prototype, as a working document. This could be in a table format with space to write on or annotate as the process progresses.  Learners will record their use of the production plan in their NEA. They should ensure the document is used throughout the final prototyping phase, and annotate changes such as:   * Issues with processes or materials * Changes to approach * Quality checks * H&S approaches * New research required * Changes to timings for each stage * Changes to the order of production * Any additional help they require to complete specific tasks. |
| **Technical Principles** Use appropriate materials, equipment and processes to create and develop a prototype from early concept through to functional outcome | **4. Design thinking and communication** Be able to design and develop at least one prototype that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics and marketability. | Provide learners time and materials to prototype and iterate the chosen concept design through to a testable solution.  For learners of all abilities it is advisable to keep a log of their practical work, including specifically any support from staff or from outside of the school, to produce the working prototype.  Acknowledgement should be documented in the candidate record form. | Learners should reflect against their production plan and ensure they have been followed, editing as they go. |

## Weeks 5-8 (3 lessons) 3 hours (each week)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Use appropriate materials, equipment and processes to create and develop a prototype from early concept through to functional outcome | **4. Design thinking and communication** Be able to design and develop at least one prototype that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics and marketability. | Provide learners time and materials to prototype and iterate the chosen concept design through to a testable solution.  For learners of all abilities it is advisable to keep a log of their practical work, including specifically any support from staff or from outside of the school, to produce the working prototype.  Acknowledgement should be documented in the candidate record form. | Challenge learners to review material sections relevant to their deeper learning that will support and inform them during the prototyping process. This could be delivered through a generic directed session but would be better done independently.  Learners can document the research alongside their iteration work, but will also want to create notes, revision tools or summary sheets of materials, processes and techniques that apply to the materials they are manipulating for their prototype. |

## Week 9 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Create the final version(s) of the prototype suitable for testing, moving into more durable materials, challenging processes and increasing levels of tolerance. | **Technical Understanding** Apply technical principles, use surface treatments  **Manufacturing processes and techniques.** Use specialist tools and equipment, work accurately | Learners should be in a position at this stage to move from easier and quicker processes towards more durable and harder processes and materials that will create a functional prototype.  Learners should at this point have resolved key issues, have a good understanding of materials and the processes they will use, and be able to fabricate their prototype with a focus on this being presented to the user/stakeholder for final testing.  Learners must employ a level of appropriate digital design and manufacturing in their NEA. If they have not achieved this at this point (through earlier iteration) then they must use it during final prototype manufacture. | Challenge learners to review material sections relevant to their deeper learning that will support and inform them during the prototyping process. This could be directed but would be better independent.  Learners can document the research alongside their iteration work, but will also want to create notes, revision tools or summary sheets of materials, processes and techniques that apply to the materials they are manipulating for their prototype. |

## Week 10-14 (3 lessons) 3 hours (each week)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Create the final version(s) of the prototype suitable for testing, moving into more durable materials, challenging processes and increasing levels of tolerance.  (continued) | **Technical Understanding** Apply technical principles, use surface treatments  **Manufacturing processes and techniques.** Use specialist tools and equipment, work accurately | Learners should continue to focus on a functional final prototype.  Learners should ensure that all key issues are resolved, and be employing the materials, processes and techniques that will achieve the level of outcome required for feasibility testing.  **Reminder** Learners must employ a level of appropriate digital design and manufacturing in their NEA. If they have not achieved this at this point (through earlier iteration) then they must use it during final prototype manufacture. | Challenge learners to review material sections relevant to their deeper learning that will support and inform them during the prototyping process. This could be directed but would be better independent.  Learners can document the research alongside their iteration work, but will also want to create notes, revision tools or summary sheets of materials, processes and techniques that apply to the materials they are manipulating for their prototype. |

# Term 2

The spring term focus is finalising the end prototype, taking the prototype through a series of feasibility tests, and finishing the term by rounding up the NEA work and providing the JCQ two week window before submitting the work to OCR Interchange or by USB to the assigned moderator. The first two weeks of this term are set aside for a typical mock examination period but suggest some activities for the department staff to complete during this time.

## Weeks 15-16 (6 lessons) – Mock exams

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| Staff Department time to review NEA progress and mark/reflect on exam performance | N/A | Whilst learners are completing the mock exam week, staff will have time to review the NEA progression of groups and individuals. Staff will want to check:   * Evidence is being kept recorded and produced in chronological order * All video evidence is working and correctly named/saved * Student work is all their own, and observation documentation is updated accordingly where other individuals have contributed to the progress of the project.   Staff may also be able to conduct an exam review, or simply mark and reflect on the exam papers completed by learners. Staff will want to:   * Share subject knowledge on how best to mark certain questions * Review and agree a shared approach to marking questions * Agree a style of annotation to communicate to the learners when they receive their exam papers back * Create a central tracking document for comparing individuals and group performance * Collaborate to support staff in marking consistently * Moderate marking between colleagues to ensure consistency   On the following webpage you’ll find a selection of past papers, mark schemes, examiners’ reports, sample assessment materials and practice papers.  <https://ocr.org.uk/qualifications/gcse/design-and-technology-j310-from-2017/assessment/>  Check out ExamBuilder, our free mock assessment service.  <https://ocr.org.uk/qualifications/past-paper-finder/exambuilder/> | Staff may wish to review other sample assessment materials, past papers and mark schemes, and plan intervention approaches to support those scoring low on specific topics or areas of the paper. These could be collated into a photocopied or digital booklet and given to learners to complete post exam results. |

## Week 17 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Create the final version(s) of the prototype suitable for testing, moving into more durable materials, challenging processes and increasing levels of tolerance.  (continued) | **Technical Understanding** Apply technical principles, use surface treatments **Manufacturing processes and techniques.** Use specialist tools and equipment, work accurately | Learners should continue to focus on a functional final prototype.  Learners should ensure that all key issues are resolved, and be employing the materials, processes and techniques that will achieve the level of outcome required for feasibility testing.  **Reminder** Learners must employ a level of appropriate digital design and manufacturing in their NEA. If they have not achieved this at this point (through earlier iteration) then they must use it during final prototype manufacture. | Challenge learners to reflect on their prototyping approach, and to document the materials, processes and techniques they employed, the learning that took place, and both health and safety considerations and quality assurance (checks).  Learners could document this as an annotated making diary, or annotation of their production plant. |

## Week 18 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Plan and carry out feasibility testing on the prototype, off site, in context, and with stakeholders, documenting the process | **8. Viability of design solutions** Be able to test, critically analyse and evaluate their design solutions against the identified stakeholder requirements, design opportunities and constraints in order to refine and improve future iterations. | Set learners with the task of planning a series of no more than 6 feasibility tests. These could directly link to each of the PUNs chosen to focus on for the iteration process.  Learners should:   * Plan the test * Describe the method of the test that will make it reliable * Record the testing (or capture its approach and outcomes) * Reflect on the outcomes of the test * Draw conclusions from the test results   Learners must ensure they have fully documented in photos and video their final prototype BEFORE final destructive testing occurs.  Learners should plan to test the prototype with numerous different stakeholders.  Provide learners time to conduct and write up the feasibility testing and reflect on the outcomes of the tests.  Learners must ensure they have fully documented in photos and video their final prototype BEFORE final destructive testing occurs.  Learners should plan to test the prototype with numerous different stakeholders. | Challenge learners to conduct testing with stakeholders away from the centre and document the testing suitable to inform the examiner of how it was conducted, and the outcomes. This should be live wherever possible.  Learners should record their outcomes and ensure this is included in their feasibility write up. |

## Week 19 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Plan and carry out feasibility testing on the prototype, off site, in context, and with stakeholders, documenting the process | **8. Viability of design solutions** Be able to test, critically analyse and evaluate their design solutions against the identified stakeholder requirements, design opportunities and constraints in order to refine and improve future iterations. | Provide learners time to conduct and write up the feasibility testing and reflect on the outcomes of the tests.  Learners must ensure they have fully documented in photos and video their final prototype BEFORE final destructive testing occurs.  Learners should plan to test the prototype with numerous different stakeholders. | Challenge learners to conduct testing with stakeholders away from the centre and document the testing suitable to inform the examiner of how it was conducted, and the outcomes. This should be live wherever possible.  Learners should record their outcomes and ensure this is included in their feasibility write up.  Challenge learners to use reflect on their feasibility testing, and critique:   * How could the tests have been designed and applied differently? * What could be changed to achieve a more reliable outcome? * Would a different stakeholder provide different feedback? |

## Week 20 (3 lessons) 3 hours

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** Plan and carry out feasibility testing on the prototype, off site, in context, and with stakeholders, documenting the process | **8. Viability of design solutions** Be able to make informed and reasoned decisions throughout the iterative design process, responding to feedback as appropriate to identify the potential next steps of further development.  Be able to respond to feedback given by others about their prototype(s) in order to identify the potential for further development and suggest how modifications could be made through design optimisation. | Provide the learners time to reflect on the feasibility testing conducted, and the result.  Learners will want to reference to the contextual challenge, the design brief, the requirements list, and compare the feedback to these, establishing the successes and areas for improvement.  Provide instruction for learners to prepare a modified or improved version of their final prototype using:   * CAD * Sketching * Sketch modelling * Sketching over photos * A combination   Learners should justify the changes they made and why these would lead to a more optimised outcome. | Challenge learners to reflect on their NEA with the submission deadline soon. Ensure all videos and live evidence is working and suitably referenced.  Learners might want to work through a checklist of tasks to ensure the examiner is able to apply the Marking Criteria appropriately through clear communication of tasks the learner has completed in their NEA time. |
| **End of NEA** Provide time for learners to prepare and submit their NEA and complete all administration paperwork to support it | N/A | **Administration** Provide learners time to format their NEA work, check videos and live documents are working, and save files to a shared location. Collect in NEA work at the end of the session for assessment.  Ensure learners complete and sign a [Candidate Declaration Form](https://www.ocr.org.uk/Images/466197-candidate-declaration-form-interactive.pdf) as part of their internal submission process to ensure the specific support received and research sources used over the NEA period are appropriately recorded for external moderation. | Learners should reflect on their project progress, and document their entire learning journey, including the research tools they applied, the prototyping they completed, and the reflective and evaluation work they conducted. |

The estimated end of the NEA in this SoW is February half term (depending on school calendar). The total number of allocated one-hour lessons is 66. It is assumed that 60-70% of this lesson time is effective activity where learners are working on NEA tasks, resulting in the total number of hours for a typical learner being 40 hours, with additional time students (+25%) working for 50 hours. The time taken to conduct specific research tasks, wider reading, testing prototypes off site with stakeholders, sourcing materials, and other similar activities is not included in this allocation.

## Week 21 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Exam Revision** Reflect against the mock examination and produce a plan of action relating to practicing question styles, and specific material areas. | All | Conduct a focused review of the Principles of Design and Technology paper, including discussion of the mock examination.  Take learners through how to structure responses to a range of question styles, from show working in mathematical questions to responding to compare/contrast or evaluate questions where extended responses can be structured to aid learners in producing higher level responses.  Use of the previous year’s [Examiner’s Report](https://www.ocr.org.uk/qualifications/gcse/design-and-technology-j310-from-2017/assessment/) will support this as it is also likely to link to the mock examination they have taken. | Challenge learners to work through 1-3 extended response questions that relate to recent project work, projects, or to materials they have studied in detail. Task learners with self-marking as an application of knowledge. |
| **Design and Make Principles** Considering Existing products and how to analyse them | 2.1a What are the opportunities and constraints that influence design and making requirements | Introduce learners to the range of factors that relate to the analysis of existing products.  Discuss a typical drinks bottle, and discuss the product (including annotation around images of the product in different contexts, materials and uses)  Use videos (examples below) for the production of the product in different materials Metals: <https://www.youtube.com/watch?v=VYCOn-MvGrQ> Plastics: <https://www.youtube.com/watch?v=8QkxpQT967w>  Set learners a task to compare and contrast the materials, how this will impact the products usability, and challenge learners to propose packaging and marketing approach for either product. Learners should link the factors to a list of pros’ and cons for the product in the material of their choice. | Challenge learners to conduct an analysis of a product from their deeper learning material area and include:   * How the product is made (find videos) * The pros and cons of the material and process choice * Redesign of the product and its packaging * Analysis of the product against the factors from the lesson. |

## Week 22 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Design and Make Principles** New and emerging technology considerations for products in the home | 2.2a How do developments in D&T influence design decisions and practice? | Provide case studies or product specifications for robotic vacuum cleaners (or similar products).  Challenge learners to identify the technology that resulted in each evolution of the product.  Learners could annotate images, order them historically, or match the specification to the product.  Learners should then read or be provided with new and emerging technology information and are challenged to redesign the evolution of the robotic home cleaner. They should sketch, CAD or model the solution, and be able to present the use of the technology.  For advanced students, they should look at how smart and modern materials will change the product, and link their learning to the electronic system inside the robot (micro controller, sensors, inputs and outputs, etc.) | Challenge learners to analyse a comparable product and present its history of development. This could be a product that is familiar such as a mobile phone, or less obvious such as textile clothing or sports equipment. Learners should look at how the product has evolved and present this back in a coherent presentation. |
| **Technical Principles** Create a visual map of all the material groups and the common categories, with memorable examples for each | 5.1 What are the main categories of materials available to designers when developing design solutions? | Learners are set a task to create an A3 visual map of all the material groups, including example materials within each sub-category.  For example, Timbers would break into soft, hard and man-made boards, and examples for each would include pine, fir and cedar, hard would be oak, teak and beech, and man-made would be chipboard, MDF and blockboard (to give examples but not an exhaustive list).  This task could be linked to a physical study of the materials as a handling collection of samples, or as a visual board with images of the materials alongside typical applications. Learners should cover a broad spectrum. | Learners could be challenged to identify and photograph (or image source on the internet) the typical applications of each material they are mapping in their lesson. They might then annotate these with features, such as visual knots in pine etc., and link these to the materials appearance, properties and applications. |

## Week 23 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Exam a series of electronic products that feature inputs, processing, and outputs, and describe the process in relation to how the product works | 6.4 How do electronic systems provide functionality to products and processes? | Provide learners with physical or images of products that feature an input, a process and an output. These should be products that are typical to the learners’ experience, e.g. a vending machine, or a sensing cycling jacket with lights.  Learners discuss the physical inputs they can make (e.g. coin in slot, input order) and then describe the outputs (e.g. information on screen, motor turning to dispense food/drink, coin return), and then propose what the microcontroller has to receive and send out to work. They should then look to link this to the physical components and try to draw these features for the product in question.  A range of products will provide challenge and scope to differentiate. | Challenge learners to analyse simple electronic products such as a kettle, fridge or microwave, and conduct the same analysis.  **Extension** to redesign the product so that they present more functionality. |
| **Technical Principles** Create a series of Mr Men style characters, one for each material property. Each should be designed to convey the specific property in relation to materials | 5.2 What factors are important to consider when selecting appropriate materials? | Provide learners with information about the range of material properties.  Providing examples for character design, the learners can use pre prepared images of eyes and mouths to cut out and draw their own Mr Men characters for each material area.  Learners could turn these into a poster that could be printed for revision. | **Extension** Challenge learners to write a story about a material that goes through change (e.g. heat treating a metal) and how its properties change. Use the Mr Men characters created to create a visual and memorable story for each. |

## Week 24 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Create moving visual boards of a range of mechanisms and systems that transfer energy, force and movement. | 6.3 How do we introduce controlled movement in products and systems? | Provide learners with templates or laser cut sets of parts that can be used to construct moving examples.  Learners can, using split pins, mount moving versions of each mechanism or system (e.g. cam and follower, slider, gears) to make moving revision sheets. Learners might need card to mount the resources on. Learners should work in pairs or groups to complete all the areas of study.  BBC Bitesize link to mechanical devices: <https://www.bbc.co.uk/bitesize/guides/zdhxh39/revision/1> | **Extension** Set learners the task of identifying the application of each movement system or mechanism in real products and use images of these to support the presentation of the learning from the classroom. |
| **Technical Principles** Provide learners with packaging for Easter eggs, and conduct a detailed critique of them, the materials, their impact on the environment, and as a packaging solution | 3.3 What wider implications can have an influence on the designing and making of products? | Provide learners with a series of questions relating to the critique of the packaging (e.g. below). Set learners a task to critique the packaging and discuss, suitable to present back to the class.   * Can I describe environmental issues around a product? * Do I know what initiatives affect that product's design? * Can I relate fair trade issues to the product? * Does the product raise any social or ethical awareness? * Does the product impact globally? | Set learners a task to critique a piece of packaging at home and write about it.  Challenge/extension would be to have the learners create a video of them unpacking the product and critiquing the packaging as they do so. This would work particularly well with specific poorly packaged Easter eggs or similar. |

## Week 25 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Use teamwork and a production line to fabricate multiple matching products, identifying the pros and cons as learners progress | 7.3 How do we achieve consistency and accuracy in products we make? | Provide the learners with the resources to make a product from a material area of choice (e.g. paper and card to make a greetings card or gift box, fabric to make a tie or handkerchief).  Group learners and challenge them to produce X matching products in a production line.  Learners could be given materials to create tools and jigs, patterns and templates to reproduce steps over with accuracy.  Learners should reflect on the progress of the production line.  Learners could discuss in relation to ethics of production lines, the automation of processes, or the materials and equipment needed to repeat tasks with accuracy. | Challenge learners to design an entirely automated approach to the production line. What equipment would they use, how would they employ CAD/CAM, and what would be the differences in relation to scales of production. |
| **Technical Principles** Analyse a physical product that has been manufactured in the department and cost it | 8. Viability of Design solutions - cost and availability of materials/components | Provide learners with information (catalogues or custom data sheets) of stock materials available in the department. Learners are then provided a product, which they need to cost. Provide web links to any specific off the shelf parts required (e.g. electronic kits etc.) and challenge learners to cost one product, a batch of products (class) and a whole year group of products).  Learners are challenged with creating a costing sheet for the product and calculate quantities and costings. | Challenge learners to manipulate the costings calculations based on scenarios  Examples might include:   * All metal parts are 20% more expensive, what is the new cost of production * How much profit could be made if the product is sold for £X amount |

## Week 26 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Set learners a task to read and summarise information on smart and modern materials, then introduce products and challenge learners to integrate the materials into the products | 7.6 How do new and emerging technologies have an impact on production techniques and systems? | Set learners a task (using textbook or handouts) to summarise and read information relating to smart and modern materials. This should include a breadth of materials from technical textiles to environment responsive materials and composites.  Introduce a series of products that are not smart and challenge the learners to choose materials and redesign the product. This can be a discussion or a design task.  Learners could have products such as smartphone cases, a toothbrush, purse, or similar everyday products.  To extend learning, the learners could look at scenarios and jobs, and relate the materials information to designing equipment and garments.  For example, what materials would and should be used by: Firemen, police, mountaineers, downhill cyclists, scuba divers, etc. | **Extension** Identify the application of all of the smart materials learnt in the lesson and try to find real life examples of these. Justify their use in each application. |
| **Technical Principles** What are the stock forms of materials and who buys them in these forms, and why? | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? | Learners create a visual map of the stock forms of materials for all of the categories of material available. (paper/card, textiles, timber, polymers, metals).  Learners map out the materials and annotate specifics (e.g. sheet sizes at 2440x1220).  Learners then discuss who buys which type and why, in relation to manufacturers and typical high street customers and answer questions. (E.g. why would manufacturers buy granules, but customers buy sheets of polymers).  Learners then look at electronic components, and review their symbols, typical appearance, and how they are drawn into circuits.  Learners consider the reasons for using symbols for circuit design and manufacture. | **Extension** Learners apply their learning to break down existing products from their lives into stock forms. E.g. what materials would a typical timber chair require, what electronic components would a torch require, etc. |

## Week 27 (3 lessons)

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| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Review a series of images of common products, and propose the production processes involved, the stock forms, and the off the shelf parts | 5.4 Why is it important to know the different available forms of specific materials and/or systems Components?  7.2 How can materials be manipulated and joined in different ways in a workshop environment when making final prototypes? | Learners are given a series of physical or image-based products across the material areas.  They are tasked with considering their design and materials, before proposing the following:   * what are the stock forms required? * what off the shelf parts are needed to make them * what finishes have been applied   They are then tasked with reviewing how the product is made and proposing a production order. This would include:   * processes that could be used to make the product * what quality checks would take place * what waste would be produced * what alternatives could be used   Learners are then tasked with considering the environmental impact of the product and proposing changes that would improve the life cycle. | **Extension** Learners are tasked with creating a map of products from their deeper learning area, and conducting an analysis where they propose how they are made, from which stock forms, their off the shelf parts, and any improvements |
| **Technical Principles** Introduce learners to a range of products that all work within the same context, and challenge learners to identify their shared properties | 5.2 What factors are important to consider when selecting appropriate materials and/or system components when designing? | Learners review their learning from earlier in the year on material properties and characteristics, including physical, aesthetic and working properties.  Learners are tasked with reviewing (either physical or image based) groups of products and identifying what properties why all need to share. What properties do they have to achieve their purpose?  Learners are then given a specific product from one of the contexts, e.g. a child’s highchair, and are tasked with identifying the materials, processes and techniques to make it, and outline the material properties required for the product to be successful. | Challenge learners to integrate new and emerging technology into the products they look at in detail, and redesign them to be evolved versions.  For example: Childs’ highchairs could feature a thermochromic eating surface that would indicate if the food was too hot to eat. |

## Week 28 (3 lessons)

|  |  |  |  |
| --- | --- | --- | --- |
| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| All | All | Focused revision session.  Provide learners with focused and supported revision that allows them to review their collated and developed revision materials, and to use these to prepare for a practice test.  Learners could focus on core or deeper learning, or simply tackle styles of questions depending on their needs as a cohort. | **Extension** Provide learners with past papers and questions with responses to revise from |
| All | All | Walk and talk practice exam Provide learners with a walk and talk exam, in which learners respond to a question, then the answer is discussed, and learners write what they missed in another colour pen.  Walk learners through each question in turn, allowing them to try first, then to review their knowledge or provide extracts from the mark scheme. | **Extension** Learners should reflect on their achievement in the exam and write down all areas in which they were short in their knowledge.  Learners could be set a task to create revision materials for the areas of weakness. |

# Term 3

The summer term focus is on examination practice, focused revision of core and in-depth learning topics, and on the development of revision groups to provide learners with a structured revision approach within their material areas. Below are a number of suggested activities that could be structured into a revision program.

## Week 29-32 (3 lessons)

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| --- | --- | --- | --- |
| **Focus** | **Specification Section** | **Learning Activities** | **Independent work/extension** |
| **Technical Principles** Learners focus on their deeper learning areas of revision, with practice questions, and making revision tools in preparation for the exam (ongoing) | **In-Depth learning areas** | Provide learners with guidance on revision of their deeper learning area. This could be in revision groups or individually, or as a class.  Learners should create tools such as:   * Summary documents * Flash cards * Visual guides * Video playlists * Audio revision materials * Practice questions * Exemplar answer * Practical tasks * Roleplay * Storyboards * Acronyms | Revision and review of subject knowledge.  Learners should practice questions, create revision tools, and work through a process of revision ready for the exam |

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