National 5 Design and Manufacture – Refinement

What is refinement?	Refinement requires convergent thinking that focusses on finding the best possible solution by looking at the facts. Candidates must record any decision taking place, this could be in the form of annotation, dimensioned sketches, models or graphics. Referencing data, i.e. anthropometric data or the use of modelling to make decisions may help candidates in this area.
What does good refinement look like?	Good refinement: ♦ details the solution ♦ makes use of facts or knowledge to refine different aspects of the product ♦ shows clear understanding of materials and manufacture. Candidates may also be generating evidence for exploration at this stage.
Why is it important to fully refine a solution?	Ensuring the final solution is fully refined and has the required information for manufacture during the design stage, will allow candidates to complete the planning for manufacture pro-forma easily and ensure that the solution can be manufactured.

Task 1: Identifying opportunities for refinement (bottle opener)

Stage	Time(m)	instruction	Observation/comments
Analysis	10	Look at the sketch of the bottle opener. What do you need to know/find out before you can manufacture this? What do you need to know to ensure it functions and performs well? (Discuss answers with the class and ensure all candidates have a note of the key aspects)	Possible areas are likely to include: ♦ length of handle ♦ number of parts ♦ material ♦ assembly method ♦ shape and size of opener ♦ dimensions of component parts
Refining	1 or 2 periods	How will you carry out the refinement for the aspects you identified? What materials or resources might you need to refine these aspects? (Discuss appropriate methods/modelling materials suitable to task) Work through the list of areas that you identified in your analysis. Ensure all decisions are noted and justified with facts or knowledge where possible. If you have made models remember to include pictures of them and state what you learned from them.	Refinement may involve research, testing, modelling, and sketching. Information can be communicated through 2D or 3D sketches, models, annotation.
Proposal	1 period	Use the information gained from your refinement to fill in the Planning for Manufacture pro-forma.	If you are struggling to fill in the pro-forma sheet, you may find the solution has not been fully refined, re-visit the previous stage. NOTE: Marks for refinement cannot be generated on the planning sheet.

Task 2: Identifying opportunities for refinement (cup holder)

Stage	Time(m)	instruction	Observation/comments
Analysis	10	Look at the sketch of the cup holder. What do you need to know/ find out before you can manufacture this? What do you need to know to ensure it functions and performs well? (Discuss answers with the class and ensure all pupils have a note of the key aspects) NOTE: The cup being held is your plastic cup from earlier.	Possible areas are likely to include: ♦ size of cup holder ♦ number of parts ♦ material ♦ assembly method ♦ dimensions of component parts
Refining	1 period	Using the card that has been provided, make an initial model of the cup holder. Your model/models should be used to refine the assembly of the components and dimensions of each component part. Add the dimensions to the sketch and add additional sketches of your own to help communicate.	Remind candidates: During the refinement they may identify problems with the sketched solution. You should make all relevant changes during your refinement to ensure the product is the best possible solution. In this task, they may strengthen, add or remove components or alter dimensions based on the information gathered through modelling and testing.