

A2 Technology & Design Unit 2 Amplification – Product Design

General

- Candidates following the system and control route are required to design and manufacture a technological product or system.
- Candidates following the product design route are required to design and manufacture a product.
- It is the responsibility of the teacher to ensure candidates identify a problem or need and ensure it provides sufficient scope to meet the assessment criteria and that the topic chosen allows sufficient intellectual challenge appropriate to an A2 course.
- A technological product must have an energy source to make it function and include a control system comprising of an input, process and output. A product will draw on content of the Product Design unit.
- A portfolio should accompany the practical component with written and graphical information produced on not more than 20 A3 pages. Students can present the portfolio in an electronic format.
- This unit draws on the knowledge and skills covered in all units but must reflect the chosen option in A2 Unit 1. It represents approximately 60 hours of work and will be internally assessed and externally moderated.

Additional guidance to staff.

It is the responsibility of the teacher, alongside the candidate to ensure that the choice of **PROBLEM** is suitable and provides sufficient scope to enable the candidate to obtain top band marks in each section. Teachers should ensure that candidates present work within the stated 20 A3 page limit.

This Unit starts with a focus on a suitable **PROBLEM** to be solved. The candidate’s work should reflect solutions to the identified problem as opposed to a **PRODUCT** redesign.

Well annotated Candidate Record Sheets can assist in the endorsement of marks.

Identification of problem, need and design specification

High (5–6)

- Problem/need clearly identified leading to precise brief.
- A fully detailed design specification allowing development of ideas.

Medium (3–4)

- Problem/need identified with appropriate design brief.
- A suitable design specification allowing some development of ideas.

Identification of problem, need and design specification

High (5–6)

- Problem/need clearly identified leading to precise brief.
 - *Candidates could consider written, photographic and/or video evidence of:*
 - *Client/end user interview;*
 - *First hand experience of the problem identified;*
 - *Case study review and analysis.*
 - *The Design Brief should be presented as a result of critical analysis and is a statement of the problem, clearly stipulating the candidate’s intentions to design. It should also state the parameters of the solutions to be developed.*

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<p>Low (1–2)</p> <ul style="list-style-type: none"> • Problem/need superficially identified, imprecise brief. • An incomplete specification, allowing limiting design development. <p>Zero should be awarded for a response which is not worthy of any credit.</p>	<ul style="list-style-type: none"> • A fully detailed design specification allowing development of ideas. <p><i>The quality of the specification is integral to all sections within the unit. A highly detailed specification will ensure that the candidate can access high band marks for design, manufacture and ultimately testing and evaluation.</i></p> <ul style="list-style-type: none"> • <i>The specification must include quantifiable/ measurable/ specific points which will assist candidates when they come to design, test and evaluate the product.</i> • <i>Suggested points for inclusion could include:</i> <ul style="list-style-type: none"> • Aesthetics • Ergonomics • Function • <i>Manufacture</i> • <i>Anthropometrics</i> • <i>Materials</i> • <i>Safety</i> • <i>Economics/Cost</i> • <i>Product life cycle</i> • <i>Inclusion for society</i> • <i>Maintenance and repair</i> • <i>Quality control and assurance</i> • <i>British Standards/CE/kite marks</i> • <i>Other appropriate points relating to the chosen problem area</i>
<p>Initial Ideas – selection of idea(s) for development</p> <p>High (14–20)</p> <ul style="list-style-type: none"> • Analyse in detail existing solutions. • Produce viable new solutions incorporating a broad range of control systems or product design features. • Produce viable new product outcomes integrating either system and application of function or 	<p>Initial Ideas – selection of idea(s) for development</p> <p>High (14–20)</p> <p>Analyse in detail existing solutions.</p> <ul style="list-style-type: none"> • <i>Analysis of existing products (at least 3) should be closely related to the design specification and other relevant factors.</i> • <i>Suitable conclusions should be drawn to assist and focus design work.</i>

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product design features, displaying innovation.

- Detailed evaluation of each idea based on relevant criteria.
- An appropriate selection of a solution for development.

Medium (7–13)

- Analyse with some detail existing solutions.
- Produce some generally viable and new solutions incorporating a moderate range of control systems or product design functions.
- Produce some generally viable and new product outcomes either with reasonable integration of system and development in application of function or reasonable product design features, displaying innovation.
- Some evaluation of ideas based on generally appropriate criteria.
- A potentially viable selection of solution for development.

Low (1–6)

- Limited analysis of existing products.
- Produce some limited solutions incorporating control systems or product design functions.
- Produce some product outcomes with either limited integration of system and application of function or limited product design features, displaying innovation.
- Superficial evaluation of ideas based on limited criteria.
- An inappropriate selection of solution for development.

Zero should be awarded for a response which is not worthy of any credit.

- Produce viable new solutions incorporating a broad range of product design features.
 - *Design solutions should be of A2 complexity. Present a broad range of viable concepts addressing all aspects of the design specification. A blend of hand graphics and CAD is encouraged within this section.*
- Produce viable new product outcomes integrating product design features, displaying innovation.
 - *Approximately 2/3 pages of original and creative product design features leading to viable new product outcomes capable of being developed to be highly functional, of A2 standard and aesthetic, ergonomic and innovative.*
 - *Innovation can be understood to be:*
 - *New, creative, original and of value in the use of:*
 - *Aesthetics*
 - *Ergonomics*
 - *Additional functions*
 - *Material & Manufacturing process/ techniques*
 - *Performance*
- Detailed evaluation of each idea based on relevant criteria.
 - *Evaluation could be on-going throughout this section or by presenting conclusions to direct and guide development.*
- An appropriate selection of a solution for development.
 - *At the end of this section candidates should state which concept(s) they intend to develop further. Conclusions should be presented to direct development.*

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<p>Development</p> <p>High (14–20)</p> <ul style="list-style-type: none">• The control system or product is highly developed to outcome.• Clear evidence of numerical analysis in development.• The product is highly developed to integrate with the user and environment.• Clear evidence of ergonomic and aesthetic development.• Present a detailed plan of manufacture.• Produce at a high level working drawings for manufacture. <p>Medium (7–13)</p> <ul style="list-style-type: none">• The control system or product is reasonably developed to outcome.• Some evidence of numerical analysis in development.• The product is developed with some integration with the user and environment.• Some evidence of ergonomic and aesthetic development.• Present with suitable detail a plan for manufacture.• Produce suitable working drawings for manufacture. <p>Low (1–6)</p> <ul style="list-style-type: none">• The control system or product is superficially developed to outcome.	<p>Development</p> <p>High (14–20)</p> <p>All work within this section, by definition, should be <u>developmental</u>, focusing on the pathway to outcome of the concept(s) from the previous section. Whilst the focus of development should draw from the content of the chosen Unit A2:1 section, <u>credit can only be awarded</u> where candidates have <u>applied</u> subject knowledge <u>directly</u> to the <u>development</u> of their <u>design solution</u>. Presentation of unrelated content from the examination unit is unacceptable.</p> <ul style="list-style-type: none">• The product is highly developed to outcome<ul style="list-style-type: none">• <i>The incremental development within this section should include investigative and proof of concept sketching and modelling to inform and support decisions taken by the candidate. Computer modelling and mock-ups are encouraged to assist candidates as they document clarification of their thinking through development.</i>• <i>Initial development pages (1-3) should clarify innovative functional characteristics taking consideration of design for manufacture and assembly, ergonomics and aesthetics.</i>• Clear evidence of numerical analysis in development.<ul style="list-style-type: none">• <i>Ideally this data is best placed throughout all pages within the development section rather than segregated and presented in isolation from the developmental context in which it is to be used.</i>• <i>Numerical analysis could be presented through incorporating analysis of some of the following:</i><ul style="list-style-type: none">• <i>anthropometric information,</i>• <i>material efficiency decisions,</i>• <i>density, stress, strain, stability, mass, weight analysis possibly using CAD,</i>• <i>dimensional considerations,</i>• <i>tolerances,</i>• <i>other related numerically focussed design characteristics pertinent to the presented design outcome(s)</i>• The product is highly developed to integrate with the user and environment.<ul style="list-style-type: none">• <i>The product should be highly developed to integrate with the user and the environment focusing on the needs of the user and the immediate and wider environmental considerations. Work could focus on the <u>refinement</u> of the outcome to A2 standard</i>
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- Limited evidence of analysis in development.
- The product is developed with limited integration with the user and environment.
- Limited evidence of ergonomic and aesthetic development.
- Present with limited detail a plan for manufacture.
- Produce with limited detail working drawings for manufacture.

Zero should be awarded for a response which is not worthy of any credit.

through a focus on:

- *Inclusive Design*
- *Design to minimise materials, components, processes and the environmental impact*
- *Recyclability to include aspects of the 6Rs*
- *Broader environmental implications of the design decisions taken by the candidate.*

- Clear evidence of ergonomic and aesthetic development
 - *The product should be developed to A2 standard to integrate high level aesthetic and ergonomic considerations. Work could focus on the refinement of the outcome through focus on:*
 - *Design for use;*
 - *Design for maintenance and repair;*
 - *Aesthetic development of form, material, selection, finish and texture.*

A clear 3D pictorial representation of the final outcome should be presented by this stage.

- Present a detailed plan of manufacture.

This plan should identify specific materials and sizes, specific components and specific manufacturing processes, assembly and finish to be used.

- *This should be written in the future tense and outline in detail the sequence of the manufacturing process.*
- *Quality control and assurance considerations could be presented.*

- Produce at a high level working drawings for manufacture.
 - *Produced in 1st or 3rd angle with appropriate, achievable dimensions for sub-assembly and/or full assembly. Details and dimensions should be provided and be sufficient to enable an independent party to manufacture the assembly and/or sub assemblies.*
 - *This should be produced and presented in conjunction with the plan for manufacture.*

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<p>Manufacture</p> <p>High (27–40)</p> <ul style="list-style-type: none"> • Produce a high quality outcome in an appropriate range of components or product design features and materials. • Demonstrate clear competence in a range of production skills and processes. • Produce a highly functional product. • Record in detail modifications made during manufacture. <p>Medium (13–26)</p> <ul style="list-style-type: none"> • Produce a good quality outcome in an appropriate range of materials and components or product design features. • Demonstrate reasonable competence in a range of production skills and processes. • Produce a functional product. • Record some detail of modifications made during manufacture. <p>Low (1–12)</p> <ul style="list-style-type: none"> • Produce a low quality outcome in an appropriate range of materials and components or product design features. • Demonstrate a limited competence in a range of production skills and processes. • Partly functional product. • Limited and superficial record of modifications made during manufacture. 	<p>Direction from the teacher should allow for a range of skills and processes for high band marks.</p> <ul style="list-style-type: none"> • Produce a high quality outcome in an appropriate range of components or product design features and materials. <ul style="list-style-type: none"> • <i>A high quality outcome is considered to be products which are be highly functional; of A2 standard and incorporate quality aesthetic, ergonomic and innovative characteristics.</i> • Demonstrate clear competence in a range of production skills and processes. <ul style="list-style-type: none"> • <i>High quality work should be manufactured in appropriately justified materials using a range of making skills and processes.</i> • <i>Both hand and CAM skills are to be encouraged for candidates to access the top marks band.</i> • <i>Products using eg. Router, Laser, 3D printer only will require additional workshop skills to achieve high quality and therefore access top band.</i> • Produce a highly functional product. <ul style="list-style-type: none"> • <i>The product should be highly innovative in its function, capable of being tested as it fulfils its principal purposes. Video evidence, in situ, demonstrating use of the product is encouraged.</i> • Record in detail modifications made during manufacture. <ul style="list-style-type: none"> • <i>Annotated photographic evidence may be used to record changes made during manufacture</i> • <i>Hidden details of the product should be recorded in the portfolio to assist moderation.</i> • <i>Storyboards of manufacture are not required.</i> <p>Note: Manufacturing should take place within the candidate’s own school or college. Accreditation cannot be given for manufacturing completed outside the school or college workshop unless the teacher has <u>directly</u> supervised such work</p>
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<p>Zero should be awarded for a response which is not worthy of any credit.</p> <p>Evaluation</p> <p>High (10–14)</p> <ul style="list-style-type: none"> • Produce a high level critical and objective evaluation of the outcome. • Carry out and present an extensive range of detailed testing, showing meaningful conclusions. • Make high level proposals for further development as an outcome of testing. <p>Medium (5–9)</p> <ul style="list-style-type: none"> • Produce a satisfactory evaluation of the outcome which is mainly objective. • Carry out and present some outcomes of tests, which show mostly meaningful conclusion. • Make appropriate proposals for further development. <p>Low (1–4)</p> <ul style="list-style-type: none"> • Produce a limited evaluation of the outcome. • Show limited evidence of meaningful testing with only simplistic conclusions. • Demonstrate limited awareness of possibilities for further development. <p>Zero should be awarded for a response which is not worthy of any credit.</p>	<p>Evaluation</p> <p>High (10–14)</p> <p>This section is worth 14% of the unit marks and should be afforded an appropriate time allocation</p> <ul style="list-style-type: none"> • Produce a high level critical and objective evaluation of the outcome. <ul style="list-style-type: none"> • <i>Objectivity could be driven by the content of the candidate’s design specification.</i> • Carry out and present an extensive range of detailed testing, showing meaningful conclusions. <ul style="list-style-type: none"> • <i>Photographic evidence, in situ where appropriate, of appropriate user testing should be presented with supporting comments leading to high level proposals for modification.</i> • Make high level proposals for further development as an outcome of testing. <ul style="list-style-type: none"> • <i>High level proposals as a result of testing should demonstrate a significant level of modifications and be drawn and annotated in detail.</i>
<p>Communication: All information presented for assessment should be presented in a coherent and concise manner using a range of ICT, illustrations, extensive photographs, annotated sketches, text and other appropriate means of communication. Where work is submitted electronically, an A4 printout should be available to assist with assessment and moderation</p>	