Course report 2022

Subject	Design and Manufacture
Level	Higher

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

The statistics used in this report have been compiled before the completion of any appeals.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022	2280

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

A	Percentage	17.5	Cumulative percentage	17.5	Number of candidates	400	Minimum mark required	106
B	Percentage	21.0	Cumulative percentage	38.5	Number of candidates	480	Minimum mark required	87
C	Percentage	29.0	Cumulative percentage	67.5	Number of candidates	660	Minimum mark required	68
D	Percentage	21.7	Cumulative percentage	89.2	Number of candidates	495	Minimum mark required	49
No award	Percentage	10.8	Cumulative percentage	N/A	Number of candidates	245	Minimum mark required	N/A

You can read the general commentary on grade boundaries in appendix 1 of this report.

In this report:

- ‘most’ means greater than 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find more statistical reports on the statistics page of SQA’s website.

Section 1: comments on the assessment

Question paper

The question paper consisted of two sections totalling 80 marks — the same structure as the previous three years. The question paper sampled each area of the course and incorporated a mixture of short response and extended response questions.

Overall, the question paper performed in line with expectations.

In a few questions, most candidates failed to demonstrate a deeper knowledge and understanding reflective of Higher level.

Assignment

SQA provided the research for the assignment, and 'Demonstrating practical modelling skills' was removed for this session. This reduced the total assignment marks from 90 to 77 marks. Assignment marks were then scaled to retain the weighting of this component within the course. The tasks for the assignment were set and assessed by SQA. Candidates chose one task from a bank of three. All tasks generated a wide range of responses and marks.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Question 1(a) was answered well by most candidates. Candidates should avoid repetition and explain six different properties/characteristics of the materials given. The answers should be appropriate to the products. There was no requirement for candidates to cover materials from both products in their answer.

Candidates should justify the property/characteristic. For example, if a candidate answered, 'the tubular stainless-steel frame is strong', they would not have been awarded a mark. To gain the mark, the candidate would need to explain why the property/characteristic is suitable; for example, 'the tubular stainless-steel frame is strong; this means it can hold the weight of the user.'

Question 1(b) was answered well by most candidates. Candidates were given credit where they gave a correct explanation to an incorrect process; for example, 'the wheels have been vacuum formed meaning no additional finishing is required.' There was no requirement for candidates to cover both products in their answer.

Question 1(d) was answered well by most candidates. Most candidates gave a good range of descriptions covering both function and safety.

Question 2(a) was answered well by most candidates.

Question 2(b) was answered reasonably well by most candidates. Most candidates were able to access at least 1 mark for explaining the suitability of compression moulding.

Question 3(a) was answered reasonably well by most candidates. Candidates should make sure they read the question; some were explaining the benefits of standard components for the manufacturer not the consumer.

Question 3(b) was answered well by most candidates. Candidates should make sure they read the question; some were outlining the benefits of using CAD in general, not during the design process.

Question 3(c) was answered reasonably well by most candidates.

Question 4(a) was answered reasonably well by most candidates.

Question 5(a) was answered reasonably well by most candidates. Some candidates struggled to meaningfully discuss the aesthetics of the kettle and therefore did not manage to attract the full range of marks.

Question 5(b) was answered reasonably well by most candidates. Most candidates were able to access at least 1 mark for identifying a correct method of protecting IPR.

Question 6 was answered reasonably well by most candidates. Most candidates gained at least half of the marks available for this question. Candidates gave a generic answer to this question and therefore were not able attract the full range of marks; for example, 'ergonomists will work with the design team looking at anthropometrics, physiology and psychology.' In this instance the candidate would only achieve 1 mark.

Question 7(b) was answered well by most candidates. Candidates understood how manufacturers could reduce the negative environmental impact of their products.

Assignment

Generating initial ideas: Most candidates demonstrated the ability to generate creative and diverse ideas with appropriate detail for higher level. Most candidates gained at least half of the marks available.

Refining ideas: Many candidates had reasonable evidence for refinement. Most candidates made decisions relating to function, sizes, materials and/or assembly methods. Some candidates used their specification very well to refine other important aspects of the proposal.

Application of design knowledge: Most candidates demonstrated knowledge relating to function, ergonomics and aesthetics. Those who used their specification to explore and refine created the best opportunities to record their knowledge. Many candidates had carried out costings or part costings using the data booklet, which gained marks in this section.

Applying graphic techniques: Most candidates used a range of graphics effectively to communicate the development and details of their proposal. Candidates benefited from the dimensioned drawings in their plan for manufacture pro forma. Many candidates gained above half of the marks available in this section.

Producing a plan for commercial manufacture: Many candidates completed the plan for commercial manufacture pro forma with reasonable information and clarity. Most candidates attempted the parts table and provided some detail about the product and its component parts.

Areas that candidates found demanding

Question paper

Question 1(c) received very mixed responses from candidates. Candidates should make sure they relate anthropometrics to a specific part of the body and then how that interacts with the product to be awarded marks for this question; for example, 'the diameter of the handles must be designed to fit the length of a child's hand.' The use of incorrect percentile ranges was ignored. Some candidates used labelling to categorise their answer in terms of anthropometrics/physiology but, at times, responses were under the incorrect label; for example, 'Anthropometrics – the force required to operate the levers must not cause additional strain (physiology).' In this instance the candidate would not have been awarded a mark.

Question 1(e) was answered poorly by many candidates. Candidates struggled to describe how production and planning processes could be used to improve efficiency. Many responses either generically discussed production/planning systems or did not describe how they would be used to improve efficiency. This shows a lack of deeper knowledge and understanding of this area of the course.

Question 2(c) was answered poorly by candidates. Candidates did not give a detailed enough description of idea generation techniques to attract the full range of marks; for example, they gave a basic description of both morphological analysis and brainstorming that would only be awarded 1 mark for each description.

Question 4(b) was answered poorly by many candidates. In most cases candidates did not give a detailed enough description of carrying out research and the information that would be gathered, and therefore did not attract the full range of marks; for example, 'Questionnaires were used to research the needs of the target market.' In most cases candidates either gave a simple description of the method or the information that would be gained, not both.

Question 4(ci) was answered poorly by many candidates. In most cases candidates struggled to describe the purpose of a product design specification and then give an example. They gave a very short response that would, in some cases, be enough for one mark with either a description of the purpose or an example.

Question 4(cii) was answered very poorly by many candidates. In most cases candidates struggled to describe the purpose of a technical specification and then give an example. They gave a very short response that would, in some cases, be enough for one mark with either a description of the purpose or an example.

Question 7(ai) was answered poorly by many candidates. In most cases candidates struggled to show a deep knowledge and understanding of material identification. Tests were often identified with little to no explanation given; for example, 'a flame test could be used to test the material.' This statement would not be enough to gain a mark as the candidate should describe the process of identification. Candidates should also make sure they specify the materials in their description; for example, wood, metal, plastics.

Question 7(aii) was answered very poorly by many candidates. In most cases candidates struggled to correctly describe how manufacturing features could be used to aid accurate and efficient assembly. This shows a lack of deeper knowledge and understanding of this area of the course.

Question 8 was designed to assess the candidates' understanding of how a variety of models can be used effectively at different stages of the design process. There was a wide range of responses to this question. Some candidates managed to answer well using good examples to illustrate their points and some candidates gave very generic answers that did not demonstrate clear understanding.

Some candidates showed a lack of understanding of the variety of models that could be used in the design process, giving a very brief description of the types of models with elements of repetition over each description.

Many of the responses were very generic in nature and did not demonstrate a deeper understanding of types of models, stages of the design process and information gained.

Assignment

Producing a specification: Few candidates were awarded marks in the top range of marks. This was because some candidates presented their specification as a list of things rather than 'it must' specification points, some lacked any specifics such as sizes, and a few candidates had points that were made up and not drawn from the research.

Exploring ideas: Most candidates had evidence for exploring ideas; however, some failed to access marks in the upper bands.

Some candidates used a centre approach exploring a design factor per page or using SCAMPER. These approaches limited the flow and content of candidates' work and often diverted candidates away from meaningful exploration driven by the specification. Some candidates explored more than one idea. Most candidates who chose to explore more than one idea showed limited diversity in the exploration of the second idea, which did not enhance their response in this section.

Candidates who made limited use of their specification failed to explore alternatives for the many different aspects of the task required to evolve the proposal.

Application of knowledge of materials and assembly processes: Although most candidates demonstrated some knowledge, some candidates did not show any application of knowledge of processes from the Higher course. For many candidates, knowledge of processes was limited to simply identifying a process. A few candidates did not record any knowledge until the plan for commercial manufacture pro forma, where it does not gain any marks.

Applying modelling techniques: Although some candidates used models effectively to generate ideas, and test and refine aspects of their proposal, many candidates were not accessing the marks available in this section. Most candidates had evidence of modelling; however, some models did not add anything new to the communication of the idea and/or the candidate did not communicate what they learned by making the model.

There was an increase in CAD models this year, however, the purpose of the models was often unclear or invalid. For most candidates, CAD models only achieved a few marks for communicating.

Section 3: preparing candidates for future assessment

Question paper

We advise centres to use the exemplar materials (for example, specimen/past question papers and marking instructions) that are available on the SQA website when preparing candidates for the examination.

Preparation for the question paper should also include training in examination techniques and how to produce acceptable responses to questions.

Many candidates did not describe or explain their answers in sufficient detail for a question paper at Higher level. Candidates will continue to struggle to produce extended answers in the question paper if they have not been used to doing this in class.

Centres should encourage candidates to discuss and debate areas of the course to enable them to acquire a technical vocabulary that allows them to produce acceptable answers in the question paper.

In addition, candidates should consider the mark allocation for individual questions when producing a response. A four-mark question generally means that they must either provide four correct statements or give an extended response to achieve full marks.

The course specification contains a section on skills, knowledge and understanding for the course assessment. This section lists the areas that may be assessed in the question paper. We advise teachers and lecturers to familiarise themselves with the mandatory content to prepare candidates to respond to these areas of questioning.

Assignment

Centres are reminded that assignments submitted must occupy a maximum of 11 A3 sheets (or equivalent), including the pre-populated research pro forma, the pre-populated research and specification pro forma, and the planning for commercial manufacture pro forma. This information indicates the volume of evidence required for candidates to comfortably access the full range of marks available in assignments.

Centres should provide candidates' original work rather than photocopies, as this will provide the best quality to mark. If they wish to keep a record of candidates' work in their centre, they should retain photocopies.

Selecting a brief: Each year candidates have the choice of three briefs. Often a candidate response can show promise but be limited by the selection of a brief not suited to their strengths. Centres should help candidates select a brief that best suits their ability.

We encourage centres to discuss the pros and cons of each task and ensure that candidates understand the breadth and depth of skills they need to demonstrate, and how they might do this, before making a final decision on the brief they wish to take forward for their assignment.

Centres could consider the following points to discuss with candidates:

- How could your ideas differ from existing solutions?
- What opportunities could you find for modelling?
- What graphic skills are required to communicate ideas for this task?
- What areas could be explored and refined?

Planning for manufacture: Centres should ensure that all candidates are provided with the plan for commercial manufacture pro forma.

The plan for manufacture is the first page that is marked. Candidates must ensure that their plan is contained on one pro forma page with no fold outs. Their plan should include a completed part table, drawing, sketch or model of the final solution, major dimensions of the assembled solution and detailed dimensions of some of the component parts. Overly simplistic parts such as flat slabs do not allow for an appropriate level of detail at Higher. We encourage centres to provide practice opportunities for candidates to incorporate features of Higher processes in their plans. Candidates must also include details of how their product assembles. They can communicate this through graphics or annotations. Centres should remind candidates that no material and manufacture knowledge is taken from the pro forma page.

Carrying out research into a given brief: Candidates will be provided with the research again for session 2022–23.

Producing a specification: Candidates must ensure they write their specification as a series of 'it must' points. It is also acceptable to write 'It must:' and then follow with bullet points. When completing the specification, candidates must include the key starting points given in the brief. One mark is allocated for inclusion of these points. It is acceptable for candidates to amend these initial points based on the additional information in the research. Candidates who achieved full marks in this section transferred the specific details and sizes from the research into their specification. A good specification should contain sufficient detail that the research pages no longer need to be referred to. The specification should not extend further than the box on the pro forma sheet.

Generating initial ideas: Candidates who accessed the full range of marks showed diversity in different aspects of their ideas, such as function, arrangement and aesthetics. Ideas clearly addressed the brief and there was detail in either the graphics or annotations. Using an appropriate idea generation technique to suit the task may help candidates generate a wider range of diverse ideas. It is not necessary to state or display the methods that have been used. Most candidates scoring in the top band had produced a wide range of ideas, demonstrating a high level of skill in this area. Using models to generate ideas can also help candidates come up with creative ideas while attracting marks for using models.

Exploring ideas: Centres should prepare candidates during the course to make extensive use of their specification to drive the exploration of aspects of their proposal; in particular, restraints such as sizes, functional requirements, ergonomics and aesthetics. Centres could prepare candidates to do this through class tasks before beginning the assignment. Candidates should also be encouraged to explore how the standard components could be used in the proposal or how well the costing meets the budget. Candidates who were

allocated marks in the top band showed clear and diverse alternatives for a wide range of aspects relating to their proposal. Effective exploration should be meaningful and driven by a problem-solving approach. Simplistic exploration such as shape change is unlikely to achieve many marks. It should be noted that the use of SCAMPER limited candidate responses and did not result in meaningful exploration at this level.

It is not advised to explore more than one idea. Candidates who did this rarely picked up any marks from the second idea as exploration was repetitive and lacked depth or breadth of issues.

Refining ideas: Centres should provide candidates with an opportunity to practise refinement activities and recording of decisions. Candidates who score best in this area use models to inform their decision making. They also incorporate the sizes of the items and anthropometrics from the specification. Encouraging use of modelling and the specification to make more meaningful decisions may help candidates in this area. Candidates should record all decisions for the design and manufacture of their solution (including dimensioned sketches, models or drawings) before completing the planning pro forma as no marks for refinement are taken from the pro forma page. Centres should encourage candidates to use the sizes of the standard component. This provides candidates with an opportunity to use the specific sizes to inform decisions on how their components will be designed to assemble to it, improving the level of detail in their work.

Application of design knowledge: Candidates who scored in the top band in this section made good use of the specification when exploring and refining ideas. This ensured they demonstrated knowledge of a range of issues relevant to the evolution of the proposal. Candidates should make use of restraints such as sizes, aesthetics, functional requirements and the standard component. Calculating simple costs for some or all components can also provide further opportunity to explore and refine. Many folios were extremely wordy this year, with the majority of the written content being unnecessary. Centres should provide opportunities for candidates to practise succinct annotation during class tasks.

Application of knowledge of materials and assembly processes: For marks in the upper bands, candidates must apply knowledge during their exploration and refinement to select and justify appropriate materials, processes and assembly methods for the components they are designing. We encourage candidates to consider the features of components. For example, incorporating diecast or injection moulded parts into their proposal provides an opportunity to demonstrate good knowledge of manufacturing features, and improves the detail and complexity of the components' design. Centres should provide candidates with an opportunity to explore the pros and cons of different materials, processes and assembly methods, either through design or disassembly tasks, before they begin the assignment.

There was still some evidence of archiving lots of material options. Centres should discourage candidates from doing this as it does not attract many marks.

Using graphics: Candidates are only required to demonstrate their use of graphics throughout the development. This may include graphics such as quick sketches, exploded details, hidden detail, dimensioned sketches, 2D and recognised pictorial sketches.

Centres should prepare candidates through a series of graphic tasks, in particular, looking at the detail of manufactured parts. Candidates with good manufacturing details in their graphics are more likely to access the full range of marks.

Applying modelling techniques: Centres should ensure candidates have an opportunity, before they begin their assignment, to use models to generate ideas, explore, test and refine aspects of a design so they develop confidence and the ability to decide when a model is required. During the course teachers should encourage candidates to use models when they have difficulty sketching an idea or where they can learn to make more meaningful decisions by using a physical or CAD model.

Models must communicate something that is not in the sketches, and annotations must explain what information has been gained from the model if it has been used to explore, test or refine. It is this record of use that attracts the marks. The standard component provides a clear opportunity to use modelling. Candidates can explore how it might fit or work and/or any changes they might make to improve or incorporate it. Physical modelling typically attracts more marks than CAD modelling. This is because candidates tend to do little more than communicate with CAD models. To access the full range of marks for modelling, there must be a range of uses.

Demonstrating practical modelling skills: Centres are reminded that 'Demonstrating practical modelling skills' has been removed for session 2022–23.

Appendix 1: general commentary on grade boundaries

SQA's main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject at every level. Therefore, SQA holds a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures including assessment modifications and revision support, was introduced to support candidates as they returned to formal national exams and other forms of external assessment. This was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic. In addition, SQA adopted a more generous approach to grading for National 5, Higher and Advanced Higher courses than it would do in a normal exam year, to help ensure fairness for candidates while maintaining standards. This is in recognition of the fact that those preparing for and sitting exams have done so in very different circumstances from those who sat exams in 2019.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2022. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and revision support.

The grade boundaries used in 2022 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the National Qualifications 2022 Awarding — Methodology Report.