

GCE

**Design and Technology:
Product Design 3D**

PROD3 – Unit 3
Mark scheme

1551 / 2551
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V1 Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Section 1

Question 1

01 Incorrect naming of the casting process should only restrict one mark, however if diagrams, descriptions and explanation of suitability are incorrect then no marks are available.

Maximum 3 marks for process description.

Mark ranges

0 marks

- No answer worthy of credit

1-4 marks

- Limited description beyond pouring molten metal into a mould.
- Reference to suitability will be very basic, if mentioned at all.

5-7 marks

- The processes will be correctly named
- Specific stages of the process will be described e.g. pattern production, moulding, pouring, ejecting/removal of part etc.
- Reference to suitability will include elements such as size of component, scale of production detail on finish.

8-10 marks

- The processes will be correctly named
- Major elements of the process are described.
- The suitability of process will be addressed with reference to size of components complexity of moulds, detail of finish.
- Where points have been made they will largely be explained with relevant details to the product in question.

Some possible points

Figure 1: High Pressure Die-casting,

Materials: Zinc alloy (allow Zinc) (other non-ferrous if reference to low melting point made)

High Pressure Die-casting:

- High level of detail achievable
- Mould can be polished to remove need for secondary finishing processes.
- Metallic moulds mean product cools quickly making this ideal for mass production.
- Used mainly for non-ferrous materials

Figure 2: Accept Sand Casting only ,

Materials: Cast Iron or Cast Steel (Accept Steel in this instance only)

Sand Casting:

- Ideal for large components due to cheap moulding material
- Used for small production runs due to short working life of each mould
- Quality of surface finish is low and requires secondary finishing processes
- Mould material means it is suitable for higher melting point metals than die-casting.

[2 x 10 marks]

02 Mark ranges

0 marks

- No answer worthy of credit

1-2 marks

- Candidate may refer to 3D printing/rapid prototyping to create components or jewellery itself.

3-5 marks

- Candidate may recognize the link to investment casting and give some details of the process.

6-8 marks

- Candidate will refer to investment casting and explain how the 3D printing/Rapid prototyping can be used to produce components in wax.
- Reference to suitability of 3D printing to bespoke designs may be made.

Some possible points

- Ideal for bespoke jewellery as the large cost can be absorbed due to the high product price.
- No restriction on form (undercuts possible)

[8 marks]

Question 2

03 Candidates may not detail the production of a whole project due to complexity, but explain individual components, they are still able to access the full mark range.

- Accept retrospective statements
- Location of diagram is not important within the answer
- QA/QC checks must explain how the check is done to be worthy of credit e.g. set the stop on the pillar drill to avoid cutting too deep
- If stages are explained without any detail of equipment or checking **limit to 8 marks**
- Specific QC/QA procedures applied (do not credit repetition of the same procedure)

Mark ranges

0 marks

- No answer worthy of credit

1-5 marks

- Candidate may use limited diagrams and stages of the plan will be vague with reference to generic material categories (metal, wood, polymer).
- The plan will miss obvious stages out in the production.

6-11 marks

- Candidate may use diagrams, which support the stages in the manufacture plan.
- The reference to some materials will be specific.
- Checking procedures may lack detail.

12-16 marks

- Candidate will use clear diagrams to support the plan.
- All materials will be specifically referenced e.g. mild steel.
- QA/QC procedures for checking product will be explained.
- For full marks (16) candidate must include diagrams.

[16 marks]

04 Mark ranges:

0 marks:

- No answer worthy of credit

1-2 marks:

- Candidate may name a measuring technique such as a ruler, depth gauge etc. and offer an obvious explanation of its use referring to a specific context

3-4 marks:

- Candidate will name a relevant measuring technique and may include basic diagrams or explanations to clarify how it is used.

5-6 marks:

- Candidate will name a relevant measuring technique and explain clearly how and why that particular technique is used in the context referred to.

Some possible points

- Reference to suitability for scale of production
- Reference to accuracy/tolerance
- Reference to speed of measurement:

e.g. go/no go gauge suitable for one specific operation and very easy to read.
Manual vernier caliper can be used for several different measurements due to flexibility, but accuracy is down to the operator and their eyesight.

[2 x 6 marks]

Question 3

05 Maximum 3 marks for manufacturing process description with diagrams per product.

Mark ranges

0 marks

- No mark worthy of credit

1-4 marks

- Candidate may give a generic material for the package, such as cardboard or thermoplastic.
- Manufacturing processes are stated, suitability for product is not discussed.
- Diagrams will lack detail, clarity and annotation

5-7 marks

- Candidates will give a relevant specific material for the package, such as carton board or PET.
- Elements of the manufacturing processes are accurately identified
- Suitability of material and/or manufacturing processes are discussed.

8-10 marks

- Candidates will give a relevant specific material for the package, such as carton board or PET.
- Manufacturing processes are accurately identified.
- Suitability of material and manufacturing processes are discussed.

Some possible points

Figure 3:

Acceptable materials: Carton Board

Acceptable processes: Die cut

DO NOT ACCEPT LASER CUTTING

- Ability to take a print finish
- Degree of rigidity
- Gloss finish

Figure 4:

Acceptable materials: PET, HDPE, LDPE, HIPS, PVC

Acceptable processes: Vacuum forming or thermoforming

DO NOT ACCEPT INJECTION MOULDING

- Transparency to allow customer to see the fresh produce
- Ease of recyclability
- Commonly available thermoplastic (used for the majority of packaging)

[2 x 10 marks]

06 Mark ranges

0 marks

- No answer worthy of credit

1-2 marks

- Candidate may refer to a list of alternative packaging options, these will not be discussed individually but as a whole.

3-5 marks

- Candidate may refer to alternatives specifically and give simple reasons for their use, such as recyclability etc.
- Alternatively the candidate may discuss some of the issues with EPS outlined below but not refer to packaging alternatives

6-8 marks

- Candidate will refer to specific alternatives and give reasons for their use referring to the issues with EPS within these reasons.

Some possible points

- Sealed air pouches
- Formed paper pulp
- Starch based 'peanuts'
- etc.

Students may reference change in expansion gas after CFC's were banned to CO₂ this is worthy of credit

Some reasons for removal of EPS packaging

- Lack of recyclability
- Toxic fumes when burnt
- Cost in forming to individual products

[8 marks]

Section 2

Question 4

**07 Max 1 mark for type of data to be collected
Max 1 mark for collection method (focus group etc.)**

Mark ranges

0 marks

- No answer worthy of credit.

1-4 marks

- Candidate will refer to basic anthropometric definition and may recognize the term percentiles
- There will be very limited diagrams, these may not be relevant e.g. refer to stature and not specific sizes.
- Collection of data referenced, but no explanation of impact on design

5-9 marks

- Candidate will refer to specific anthropometric data such as length of back and heel to knee length (this may be done as annotations on diagrams)
- There may be reference to adjustments on the chair.
- Collection and relevant use of data referred to.

10-14 marks

- Candidate will refer to a range of relevant specific anthropometric data.
- The candidate will refer to adjustments on the chair explaining how the range of movement needs to be determined by relevant anthropometric data
- Clear diagrams will be used to support the points made.

Some possible points

A diagram of the chair will assist with the points been made and should not be credited specifically, but the annotations when highlighting features on the diagram will be awarded credit.

- Reference to anthropometric data being used
- Reference to the use of a range of sizes, (not the average size)
- Reference to percentile range from 5th to 95th percentile
- Explanation of why the top and bottom five per cent of results are not used
- Adjustment available on the chair e.g. seat height, back angle, back height.
- Reference to each specific measurement needed e.g. 'buttock popliteal length' for seat depth.
- Reference to eye level and interaction with other objects such as computer keyboard and monitor etc.

[14 marks]

08 Mark ranges

0 marks

- No answer worthy of credit

1-4 marks

- Candidate may refer to functional aspects, such as stacking and low cost of material, but the explanation of these points will be limited to obvious statements not always relevant to the classroom context.

5-9 marks

- Candidate will refer to functional aspects as above and also recognize some relevant material properties such as self-finishing nature of PP.
- The explanation of points made will add detail relevant to the classroom context.

10-14 marks

- Candidates will refer to functional aspects and material properties with explanations relevant to the classroom context.
- There will be an understanding of how the form of the product has been designed for the specific context, this may be as simple as the addition of a textured surface on the seat to increase durability.

Some possible points

- Accept PP or ABS only
- PP = Chemical resistance (Graffiti and chemical removal of such)
- PP = Work fatigue resistance (single piece seat with repeated bending)
- Texture has been applied to the seat surface to reduce visibility of scratches and increase life expectancy
- Handle has been added to back for ease of movement, ideal when changing seating layouts in a classroom
- Seat and legs are bolted together allowing replacement of single parts not necessarily the whole chair (this can be done on site easily)
- Front and back legs loop together to spread the force over all the fixtures if students swing on the rear legs.
- The chairs stack in stable columns to save space.
- The use of standardised seats and legs means that a wide range of different aesthetics can be achieved without further investment in machinery.

[14 marks]

Question 5

09 Mark ranges

0 marks

- No answer worthy of credit

1-3 marks

- Candidates may use a list structure to give details of features available on a mobile phone with limited explanation of the effect on society.
- There will be no discussion of the negative aspects of a mobile phone

4-7 marks

- Candidate will explain features and relate to the impact on society, such as communication and access to news etc.
- There may be reference to negative aspects of the development of the mobile phone, such as cyberbullying etc.

8-12 marks

- Candidates will refer to positive and negative impacts of the mobile phone seeing both sides to a range of points made.

Some possible points

- Increased speed of communication
- Use of texting, possible impact on literacy
- Cyberbullying
- Always available/lack of privacy
- Allows all to express views on current issues
- Greater record of memories (camera phones always available)
- Health scares
- Reliance on device (must be justified)
- Distraction when driving
- Antisocial issues

[12 marks]

Question 5

Watch out for repetition of 'large' for buttons, screen etc. do not over credit (max 2).

10 Mark ranges

0 marks

- No answer worthy of credit

1-5 marks

- Candidate will refer to a list of unexplained features with very limited use of diagrams.

6-11 marks

- Candidate will use one or more clear diagrams to describe features relevant to the elderly.

12-16 marks

- Candidates will use several clear diagrams to explain the relevance of specific feature to the elderly. They may refer to specific issues faced.

Some possible points

- Use of texture to improve grip
- Use of large buttons to increase ease of use for people with arthritis
- Increase of space between buttons
- Backlit screen for increased visibility
- Voice recognition
- Emergency call button
- Vibrate alert

[16 marks]

Question 6**11** Mark ranges

0 marks

- No answer worthy of credit

1-4 marks

- Candidate will refer to some points but fail to give details of their relevance

5-9 marks

- Candidates will refer to safety specific points such as material, visual safety or product form with some explained.

or

- (max 9 marks) A large number of points are made with no explanations

10-14 marks

- Candidates will refer to specific safety points covering aspects such as material use, visual safety and product form with explanations.

Some possible points:

- Accept rigidity of UF but 'strong' is not acceptable as a property
- Cable grip to prevent exposure of wires
- Use of standardised EU wiring colours brown for live, blue for neutral and green/yellow for earth
- Use of a thermoset polymer due to high electrical insulation value
- Use of a thermoset polymer as it will not burn or melt exposure live wires.
- Earth pin is longer than live and neutral therefore connected last when removing from socket.
- Insulation is wrapped round live and neutral pins to reduce risk of contact.
- Position of earth pin prevents insertion of plug the wrong way round
- Inclusion of a cartridge fuse to isolate the appliance if the current is too high
- Finger indents on sides to assist with removal from the socket.
- Polymer divider between live and neutral to prevent loose wires touching each other.

[14 marks]

12 Mark ranges

0 marks

- No answer worthy of credit

1-4 marks

- Candidate refers to a category of product with points made not always directly related to safe disposal of materials. The points made are not often explained.

5-9 marks

- Candidates refer to specific points with explanations largely related to safe disposal of materials.
- Relevant legislation may be mentioned.

10-14 marks

- Candidates refer to specific points with explanations related to safe disposal of a range of materials/components.
- Relevant legislation will be mentioned and contextualised.

Some possible points

White goods:

- Product buy back/ disposal by electrical supplier when a new product is delivered
- Use of temporary fixings/snap fixings to aid with disassembly
- Bar coding of all components to identify specific materials used
- Removal of CFC's from coolant systems
- WEEE legislation
- Reduction in use of heavy metals
- Specialist recycling of components such as motors to recover copper etc.

Motor vehicles:

- Use of temporary fixings/snap fixings to aid with disassembly
- Bar coding of all components to identify specific materials used
- ELV legislation
- Recycling of car tyres into rubber surfaces for playgrounds

[14 marks]