GCSE
DESIGN AND TECHNOLOGY: RESISTANT MATERIALS TECHNOLOGY
45601

UNIT 1 WRITTEN PAPER

Mark scheme

June 2017

Version: 1.0 Final

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

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

1 Give **three** design requirements for public seating.

Use the following criteria to mark questions 1 (a), (b) and (c).

Award **1 mark** for a correct Requirement and up to **2 marks** for a correct Explanation.

Note: Each Requirement numbered below corresponds with the equivalently numbered Explanation. Candidates may gain marks for a correct Explanation even if the Requirement is incorrect. Candidates may also give you both the Requirement and the Explanation in one part of their answer.

Any **three** correctly identified requirements.

Possible responses:

- It should be secured to the floor
- It should be capable of being manufactured in quantity
- It should be safe to use
- It should be ergonomically designed/comfortable
- It should be styled to compliment the shopping environment
- It should be compact
- It should be environmentally friendly
- It should be cost effective
- It should be durable/robust
- It should not damage the floor
- It should accommodate all use

[3 x 1 marks]

Any **three** relevant explanations

Possible responses:

- Because this will prevent people moving the seating **as** this could cause an obstacle for people walking
- Because making things in bulk reduces the unit cost **and** this means the owners of the shopping centre will be able to install more seating.
- Because no one should be injured when using the seating. **The** public may claim against the shopping centre if they got injured.
- Because it should be easy **and** comfortable to use by the shoppers.
- The shopping centre is a clean modern looking environment **and** the seating should not look out of place.
- The seating should not take up too much room **as** large numbers of people have to move around
- Because we should reduce the amount of non-renewable materials we use **as** this will help protect the environment.
- Because if it is relatively inexpensive the owners of the shopping centre will be able **to** install more seating
- Because it will have heavy use every day **and** will need to last a number of years.
- Because this would costly **and** time consuming to repair
- Because no one should be disadvantaged **or** discriminated against

[3 x 2 marks]

2 (a)

Use the information in the Design Brief on page 2 and your answers in Question 1, to help you sketch **three** different designs for public seating suitable for use in an indoor shopping centre.

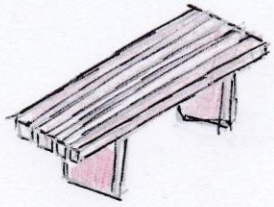
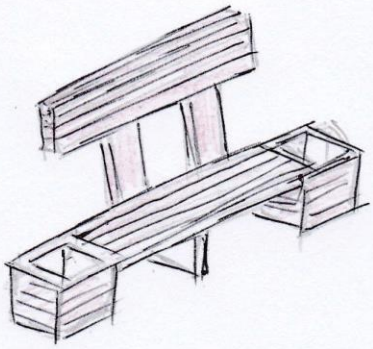
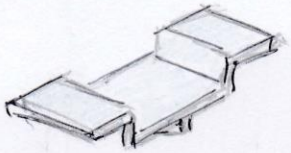
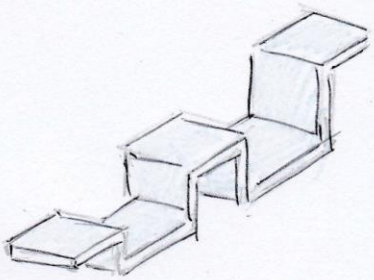
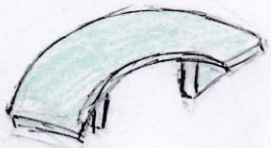
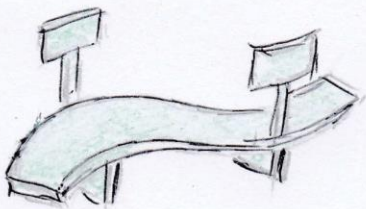
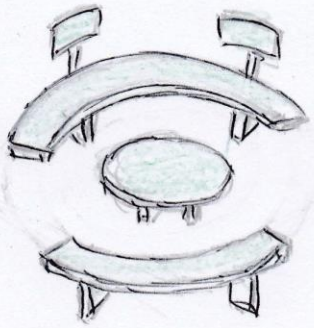
Marks will be awarded for creativity.

Mark each idea out of 3 using the following scale:

- An original, creative idea with two or more features e.g. seat, arms, back, 3 marks
- An idea with two features e.g. seat, arms or a back 2 marks
- A idea, with one feature e.g. a seat 1 marks
- No response worthy of credit/ a repeat idea 0 marks

3 x 3 marks

Q2a Exemplar answers – Public seating for the general public

1 mark A simple idea	2 marks An idea that displays some creativity or additional design features	3 marks An idea that displays creativity or several design features
		
		
		

2 (b)

Use the information in the Design Brief on page 2 and your answers in Question 1, to help you sketch **two** different designs for public seating in an indoor shopping centre.

The seating should be designed for use by young children.

Marks will be awarded for creativity.

Mark each idea out of 3 using the following scale:

- An original, creative idea that is specifically designed for young children with two or more features e.g. seat, arms, back, primary colours, animal themes, cartoon themes or a play/activity area 3 marks

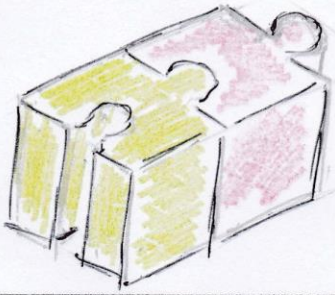
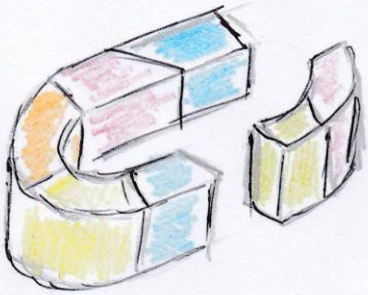
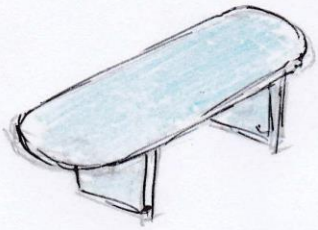
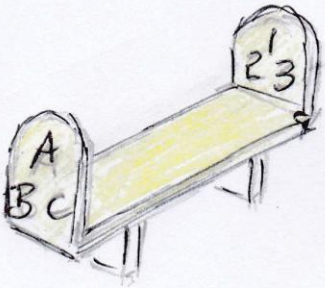
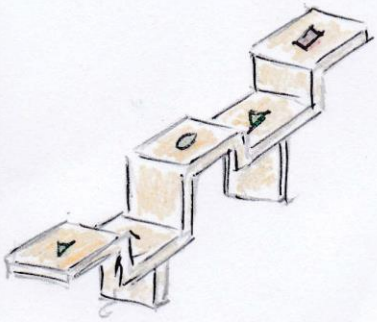
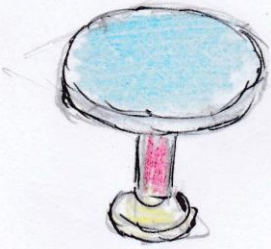
- An idea that is specifically designed for young children. With two design features e.g. a seat and use of primary colours and an animal/cartoon theme 2 marks

- A idea that is specifically designed for young children. e.g. a seat and use of primary colours 1 mark

- No response worthy of credit or a repeat Idea 0 marks

2 x 3 marks

Q2b Exemplar answers– Public seating for young children

1 mark A simple idea	2 marks An idea that displays some creativity or additional design features	3 marks An idea that displays creativity or several design features
		
		
		

3 Choose **one** of your designs from Question 2.

Use notes and sketches to show how you would develop your design.

Marks will be awarded for details of:

- how you developed your design to meet the needs of the user [3 marks]
- construction [3 marks]
- design features and sizes [3 marks]
- of materials and finishes (explain your choices) [2 marks]

Development details could include:

Award up to three marks for a developed idea of how the design meets the needs of the user

- Detailed development (three specific, features explained or two specific features with some justification or one specific and fully justified feature) [3 marks]

- A development (two specific and features explained or one feature with some justification) [2 marks]

- One specific feature identified [1 mark]

Construction

Award up to three marks for constructional details

- Detailed information relating to a method of construction or three methods identified [3 marks]

- An outline of a method of construction or two methods indented [2 marks]

- A simple reference to a method of construction [1 mark]

Design features/sizes

Award **one** mark each for details relating to up to **two** generic design features.

Award **one** mark each for up to **two** relevant sizes.

Note: Assume all dimensions are in mm unless otherwise stated. Imperial measurements are acceptable. All dimensions should be realistic to be awarded a mark.

[3 marks]

Materials and finish

One or more specific material(s) **and** one or more relevant finish(es) identified and **both** justified. 2 marks

One or more specific material(s) **or** one or more relevant finish(es) identified and only **one** justified 1 marks

Generic materials (wood, metal plastic) and an inappropriate finish(es) 0 marks **11 marks**

4 (a) Use notes and sketches to clearly show how you would make a batch of **ten** acrylic headphone holders in a school workshop.

The headphone holder is to be designed and cut using Computer Aided Design (CAD)/Manufacturing (CAM) techniques and then bent into shape.

You should include details of:

- CAD [3 marks]
- CAM [3 marks]
- Bending [3 marks]

Name all the equipment and software that you would use.

Award one mark for each point made up to a maximum of 3 marks using the following descriptors.

CAD

Sufficient detail for the design to be drawn using CAD by a third party. Most tools and equipment given.
Look for details relating to:

Computer hardware
Naming software
Net on screen
Use of different coloured lines
Reference to copying 10 times /tessellation **1 – 3 marks**

CAM

Sufficient detail for the design to be manufactured by CAM. Most tools and equipment given.
Look for details relating to:

Transfer of data to CAM
Laser cutter/CNC router
Power setting
Safety

1 – 3 marks

Bending

Sufficient detail for the design to be bent.
Most tools and equipment given.

Look for details relating to:

Use of the strip heater/line bender
Heating the acrylic
Checking for flexibility
Bending on the engraved line
Use of a former/jig
Health and safety

1 – 3 marks

9 marks

4 (b) Use notes and sketches to clearly show how you would make a batch of **ten** pine bases.

The bases should be made by **traditional methods (not using CAD/CAM)**, in a school workshop.

You should include details of:

- Marking out [3 marks]
- Cutting [3 marks]
- Finishing [3 marks]

Name all the tools and equipment that you would use.

Marking out

Sufficient detail for most of the design to be marked out by a third party. Most tools and equipment given.

Look for details relating to:

Pencil
Rule
Compass
Template

1 - 3 marks

Cutting and shaping

Sufficient detail for some of the design to be cut and shaped by a third party as a one off. Most tools and equipment given.

Look for details relating to:

Clamping
Sawing
Shaping/machine sanding (accept filing)
Safety

Turning on a wood lathe

Sufficient detail for some of the design to be cut and shaped by a third party as a one off. Most tools and equipment given.

Look for details relating to:

Preparing and mounting the blank onto the lathe
Turning the blank
Safety

1 - 3 marks

Finishing

Sufficient detail for some of the design to be finished by a third party. Most tools and equipment given.

Look for details relating to:

Sanding
Cleaning
Naming a suitable finish e.g. varnish, Danish oil, painting

Applying the finish
Safety

1 - 3 marks

4 (c) Use notes and sketches to clearly show how you would fix the acrylic headphone holders to the Pine bases.

Sufficient detail for the acrylic stand to the wooden base by a third party. Most tools and equipment given.

Name all the tools and equipment that you would use.

Gluing

Look for details relating to:

Keying the surfaces
Applying the glue. Epoxy resin (Araldite)(Not PVA)
Clamping
Safety

OR

Screwing

Look for details relating to:

Marking out
Drilling a pilot hole/using a bradawl/use of a modern 'turbo' screw
Countersinking (optional)
Use of a screw
Use of a screw driver/cordless drill

1 - 3 marks

5 (a)

Complete the table by placing a tick in the correct box to show whether the material is a thermoplastic or a thermosetting plastic.

If a candidate has ticked both boxes award no marks.

Material	Use	Thermoplastic	Thermosetting plastic
Acrylic (PMMA)	Car indicator lens	✓	
Polyethylene terephthalate (PET)	Fizzy drinks bottle	✓	
Melamine formaldehyde (MF)	Kitchen worktop		✓
Low density polyethylene (LDPE)	Plastic carrier bag	✓	
Urea formaldehyde (UF)	Electric plug socket		✓

(5 marks)

5 (b) Discuss the **advantages** and **disadvantages** of using manufactured boards, rather than solid wood to make furniture.

Quality of Written Communication will be assessed in this question.

Note: Initially mark the answer for technical content, then apply to the mark boundaries and be prepared to adjust the initial mark depending on the quality of QWC**.**

If candidates fail to address both the advantages and disadvantages, the maximum mark is 6

Award 1 mark each for identifying a valid advantage/disadvantage and one extra mark for a suitable qualifying comment.

Possible responses:

Advantages

- Available in wide boards, 8’ x 4’ (2440mm x 1220mm)
- Dimensionally stable, doesn’t swell or shrink
- Smooth surface, doesn’t need planing
- Doesn’t warp, twist, cup, split
- Environmentally friendly, made from recycled wood
- Cost effective, cost less than solid wood
- Strong, plywood has alternating grain

Disadvantages

- Not as decorative, mdf is very bland with no grain
- Hazardous to your health, mdf dust is carcinogenic
- Harmful to the environment, many manufactured boards contain glue that prevents them being recycled
- Weak

A fully detailed and comprehensive response that includes details of many of the examples above. The answer is well-structured, with good use of appropriate design & technology terminology and showing a good grasp of grammar, punctuation and spelling. Both advantages and disadvantages have been addressed.	7 - 8 marks

A fairly detailed response which refers to some of the examples above. The answer is fairly well structured, with some use of design & technology terminology and with a small number of errors in grammar, punctuation and spelling.	5 - 6 marks	
A response which contains a one or two of the examples above. The answer has some structure, with some use of design & technology terminology and with a number of errors in grammar, punctuation and spelling.	3 – 4 marks	
A response which contains very limited reference to any of the examples above. The answer is vague or poorly structured, with little use of design & technology terminology and with a considerable number of errors in grammar, punctuation and spelling.	1 - 2 marks	
A response which is poorly structured with no relevant examples. There is very little or no use of design technology terminology and with many errors in grammar, punctuation and spelling.	0 marks	**(8 marks)**

6 Produce a flow chart clearly describing the stages in producing the wood joint.

Note: If a candidate has provided extra information then simply look for the correct use of the following.

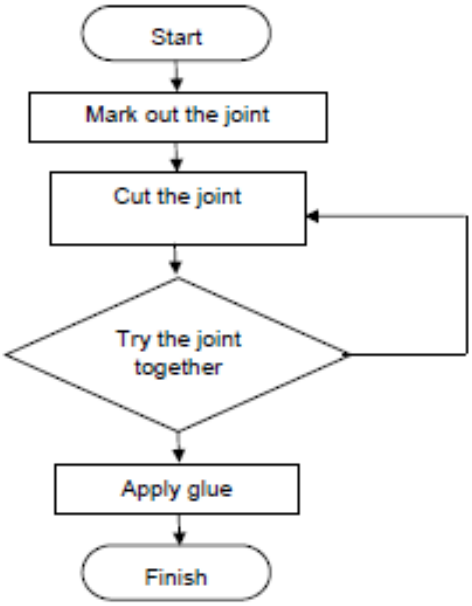
Award marks for the correct sequencing of the process using the following banding:

Three or four correctly sequenced stages of the process 3 marks
Two correctly sequenced stages of the process 2 marks
One stage in the process correctly sequenced: 1 mark

All stages of the process are correctly sequenced.

- Award 1 mark for the correct use of a process box
- Award 1 mark for any correct use of a decision box (Candidates may use decision boxes after any stage)
- Award 1 mark for the addition of the finish terminator
- Award 1 mark for the addition of flow arrows
- Award 1 mark for a return arrow

Possible responses:



Max 8 marks

7 (a)

Study the products shown below.

Name **one** suitable, specific material which has been used to make each product.

Give **one** reason for **each** choice.

Give the original source of the material.

Award one mark for each correct answer.

Metal table

Material:	Cast iron (accept iron) Aluminum Steel **(1 mark)**
Reason:	Strong Durable Suitable for mass production Heavy/Dense **(1 mark)**
Original source of material:	Ore Hematite (iron) Bauxite (aluminum) Not recycled **(1 mark)**

Wooden table

Material:	Any specially named wood **(1 mark)**
Reason:	Attractive colour High quality finish Environmentally friendly Durable Strong **(1 mark)**
Original source of material:	Trees Forest **(1 mark)**

Max 6 marks

7 (b) Explain the advantages of using composite materials.

Award one mark for each point made. Award an extra mark for a developed response.

Possible responses:

Composite materials are made from two or more materials
GRP is made up of fibre glass mixed with polyester resin
The mixing of the materials improves the properties of the material
It makes the product stronger
It makes the product lighter

Composite materials can be moulded into shape

Allow references to other composites such as metal alloys manufactured boards, reinforced concrete etc.

4 marks

8 (a) An engagement ring is an example of a product made as a **one-off.**

Explain why an engagement ring would be made by **one-off production.**

Award 1 mark each for an explanation as to why a engagement ring would be made as a one off. Award an extra mark(s) for a developed answer.

Possible responses:

An engagement ring is sold in relative small numbers. A person wants an engagement ring to be unique.

An engagement ring is made from precious metals. Precious metals are expensive.

An engagement ring is made to fit a specific finger. It can be hand made to ensure a perfect fit.

An engagement ring is very intricate. It is difficult to make by machine. It needs to be made by a highly skilled craftsperson.

4 marks

8 (b) A mountain bike is an example of a product made in batches.

Explain why a mountain bike would be made by **batch production**.

Award 1 mark each for an explanation as to why a mountain bike would be made by batch production Award an extra mark(s) for a developed answer.

Possible responses:

A mountain bike is sold in volume. There is a high demand for this product.

Change in fashion or technology developments means that the mountain bike style will need to evolve.

Mountain bike riders want value for money. The bike must be made to an affordable price.

Many parts of the mountain bike are standard / interchangeable with other bikes.

Machines can be used to manufacture many of the parts of a mountain bike.

During batch production a manufacturer produces a quantity of one type of mountain bike, (say 2,000, could be 100,000), then a quantity of another type.

Machines are 'flexible' (rather than dedicated to one task only) so that they can easily be set up for different batches **4 marks**

Quantities and batch sizes can be adjusted to suit demand for the different types of products.

8 (c) A soft drink can is an example of a product made continuously.

Explain why soft drink cans would be made by **continuous production.**

Award 1 mark each for an explanation as to why a soft drinks can would be made by continuous production.
Award an extra mark(s) for a developed answer.

Possible responses:

Soft drink cans are sold in very large volumes. There is a very high demand for this product.

Soft drink cans must be manufactured 24/7 in order to keep up with demand.

Soft drink cans must be made by a fully automated

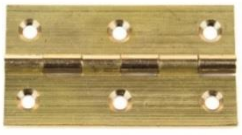
process to reduce the unit cost.

Soft drink cans are a standard size and therefore are ideally suited to continuous production techniques.

4 marks

9 (a) Complete the table shown below by correctly naming each component.

Award 1 mark for each correct answer

Fixing	Name
	Screws
	Dowels
	Modesty block/corner block, connecting block, assembly block/KD fitting/shelf support
	Hinge

4 marks

9 (b) Explain why a furniture manufacturer would decide to buy pre-manufactured components rather than make them.

Award 1 mark each for an explanation as to why a furniture manufacturer would decide to buy pre manufactured components rather than make them themselves. Award an extra mark(s) for a developed answer.

Possible responses:

Naming premanufactured components e.g. screws, nuts, bolts.
It is cost effective to buy pre manufactured components.
Pre manufactured components are made by companies that specialise in this product.
The companies can make them in very high volumes.
They can be made to a low price.
They can be made to a high quality
Consistent/standard sizes
JIT/purchased as and when required

4 marks

10 (a) Identify and describe **three** ergonomic features of the kettle.

Award one mark for a correctly identified ergonomic feature and up to two marks for a detailed description.

Possible responses:

Feature: Handle
Description: The handle has finger grooves. These help to provide a secure grip on the kettle. Rubberised grip. Thermal insulator.

Feature: Water gauge.
Description: This tells you exactly how much water is in the kettle. This will help you decide if you need to fill the kettle.

Feature: On/Off switch
Description: This is shaped to be easily flicked on and off. It is positioned at the rear of the kettle close to the handle.

Feature: The kettle is cordless.
Description: This makes it easy to take to the tap/cup. You do not need to unplug it.

Feature: The lid opener.
Description: The lid opener has been positioned for easy operation with your thumb. This makes it easy to fill the kettle.

9 marks

10 (b) Explain what is meant by the term **anthropometric data.**

Give examples of how anthropometrical data has been used in the design of the kettle.

Award up to four marks for details relating to:

Possible responses:

Anthropometric data is a table of average sizes of the human body.
Average sizes are taken from the 5th to the 95th percentile.
The average size of an adult hand has been used to influence the diameter of the handle.
The average size of an adult finger has been used to influence the positioning of the switch.

4 marks