



**General Certificate of Secondary Education
June 2012**

**Design and Technology: 45601
Resistant Materials Technology**

(Specification 4560)

Unit 1: Written Paper

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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 to download from the AQA Website: www.aqa.org.uk

Copyright © 2012 AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

1 Any **three** correctly identified requirements.

Possible responses:

1. Should keep the jewellery clean
2. Must be soundly constructed
3. Should organise the jewellery
4. Should be capable of being manufactured in quantity
5. Must be safe to use
6. Must be ergonomically designed
7. Must be durable
8. Should keep the jewellery secure
9. Should have a CRM feature
10. Should be made from sustainable materials

Check candidate has not repeated the given example
Check candidate has not stated 'in the style of Charles Rennie Mackintosh'

Allow up to 2 safety related answers.

(3 x 1 mark)

Any **three** relevant explanations

Possible responses:

1. Prevent the jewellery from becoming tarnished or dusty
2. It should not break when in use
3. This will make finding your jewellery easy
4. Making things in bulk reduces the unit cost
5. No one should be injured when using the jewellery storage device
6. It should be easy and comfortable to use
7. It should withstand everyday use
8. It should prevent the jewellery from being stolen
9. A Mackintosh Rose
10. The store device should be made from wood

(3 x 1 mark)

6 marks

Check candidate has not repeated the given example

2 Initially, mark each idea out of 3 using the following scale:

- A repeat idea *0 marks*
- A simple, obvious idea lacking in detail *1 mark*
- A simple idea displaying some creativity *2 marks*
- An idea that displays creativity *3 marks*

If 3 or less ideas have been produced then they do not need to be in the style of Charles Renee Mackintosh

If 4 ideas have been produced then 1 idea must be in the style of CRM. Cross out the weakest idea if CRM has not been addressed.

If 5 ideas have been produced then 2 ideas must in the style of C R M. Cross out the 2 weakest ideas if CRM has not been addressed.

Notes and colour are not essential at this stage

15 marks

3 Development details could include:

Materials and finish

Award one mark each for details relating to two materials.

or

Award two marks for a single material with a justification

Award one mark each for details relating to two types of finish

or

Award two marks for a single finish with a justification

Max 3 marks

Construction

Award up to three marks for constructional details

- A simple reference to a method of construction 1 mark
- A outline of a method of construction 2 marks
- Detailed information relating to a method of construction 3 marks

Design features/sizes

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

Award one mark each for two relevant sizes

Max 3 marks

9 marks

4 Award **one** mark **each** for an analytical comment.

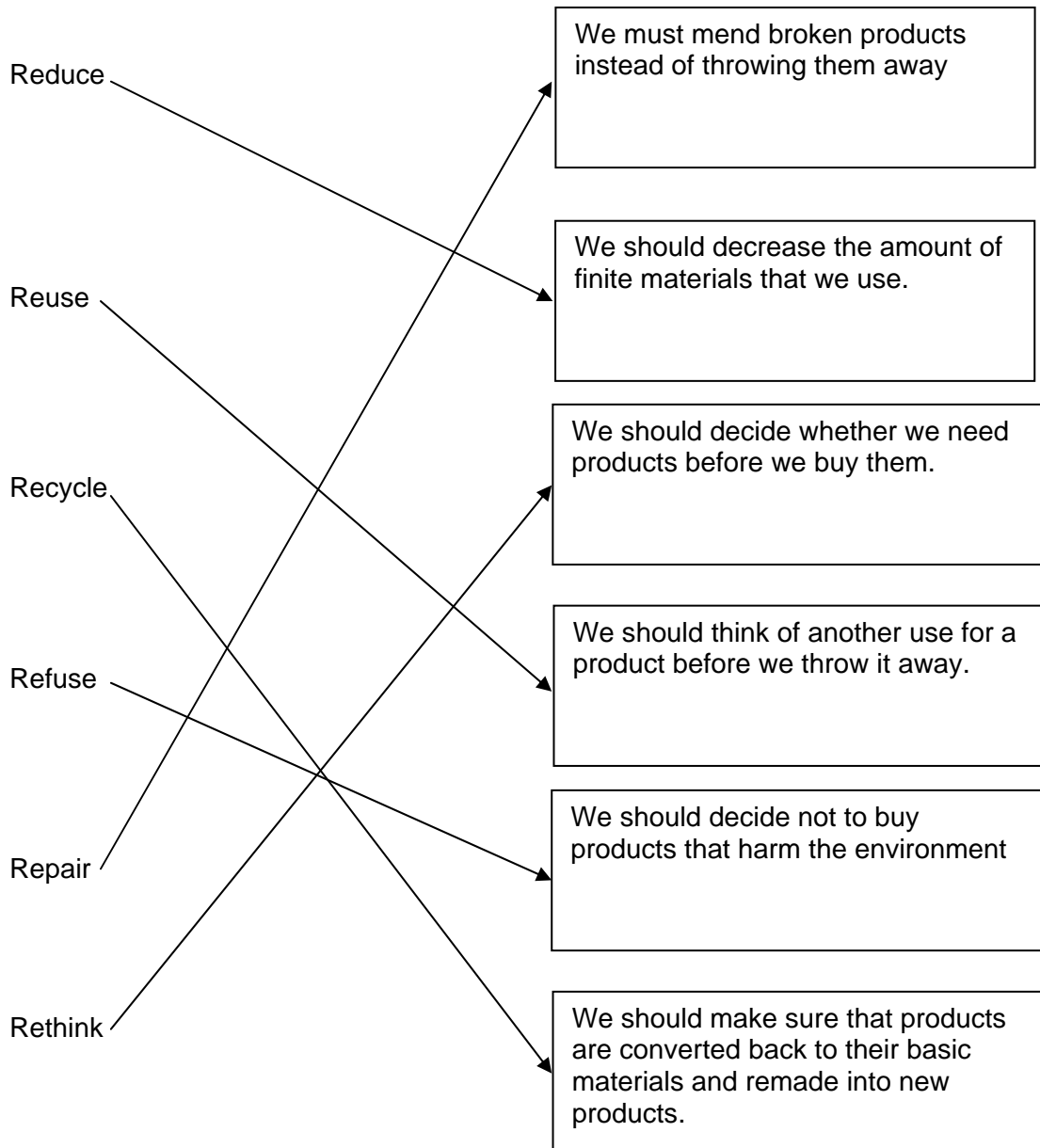
Comments must be justified to be awarded mark.

- A response that simple states features of the design without any qualification or judgemental comment 0 mark
- A basic response that qualifies or makes a judgemental comment about a design feature 1 mark
- A simple response that qualifies or makes a judgemental comment about some design features 2 mark
- A detail response that qualifies or makes a judgemental comment about several design features 3 mark

(3 x1 mark)

3 marks

- 5 a Award **one** mark for **each** correctly linked R.
Up to a maximum of 5 marks
Candidates may choose to number or label instead of using lines



(5 x 1 marks)

- 5 b** Award **one** mark **each** for any of the following details or **two** marks **each** for an expanded detail:

Glass bottle

Possible responses:

- Glass is made from sand
- Glass is made from a non renewable resource
- Glass is made from a plentiful resource
- Glass is reusable
- Glass is recyclable
- It takes energy to produce glass

Max 4 marks

Plastic bottle

Possible responses:

- Plastic is made from a non renewable resource
- Plastic is made from oil
- Oil is a finite resource
- Plastic can be recycled
- It takes energy to produce plastic
- Plastic bottles can be reused

Max 4 marks

13 marks

- 6** Award marks using the following descriptors
Full marks may be awarded to candidates who provide only notes or only sketches

Stage 1: Marking out (traditional)

Sufficient detail for most of the design to be marked out by a third party, as a **one off**. Most tools and equipment given (1 – 2 marks)

Sufficient detail for most of the design to be marked out by a third party, **in quantity**, using a **template**. Most tools and equipment given. (3 – 4 marks)

or

Stage 1: Marking out CAD

Sufficient detail for the design to be drawn by 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
Power settings (1 – 4 marks)

Stage 2: Cutting and shaping (traditional)

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 (1 – 2 marks)

Sufficient detail for most of the design to be cut and shaped by a third party, in quantity, using **power tools, jigs**. Most tools and equipment given. (3 – 4 marks)

or

Stage 2: Cutting and shaping CAM

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

Look for details relating to:

Tessellation of design
Transfer of data to CAM
Laser cutter / CNC router
Power settings/material selection
Clamping work piece
Changing tools
Safety (1 – 4 marks)

Stage 3: Bending / joining

Sufficient detail for some of the design to be bent and/or joined by a third party. Most tools and equipment given (1 – 2 marks)

Sufficient detail for most of the design to be bent / joined, **in quantity**, by a third party with use of **jigs / formers**. Most tools and equipment given. (3 – 4 marks)

or

Stage 3: Bending / joining CAM

This detail may be credited if given in Stage 2

Laser cutter / CNC router
Transfer of data to CAM
Description of how to cut the joints (1 – 2 marks)

Sufficient detail for the spice rack to be physically bent or joined together by a third party (1 – 2 marks)

Stage 4: Applying the surface finish (traditional)

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

Look for the following details:

Material preparation
Use of a brush / aerosol / rag / abrasive paper
Application of varnish / paint / brasso (1 – 2 marks)

or

Stage 4: Applying the surface finish (CAM)

Reference to the fact that a laser cut spice rack would not need finishing as the laser produces a good quality finish.

or

Reference to improving the quality of laser cut edges by use of wet and dry paper, 'Brasso' and polishing/buffing (1 – 2 marks)

Stage 5: Producing the ‘Spice jars’ text (traditional)

Sufficient detail for the logo to be applied by a third party,
tools and equipment given

Look for the following details:

Use stencil / template

Application of varnish / paint

(1 – 2 marks)

or

Stage 5: Producing the ‘Spice jar’ text (CAD / CAM)

**This detail may have be credited if given in Stages 1 and
2**

Reference to the fact that the logo would be etched in by the
laser

Look for the following details:

The logo being produced on a graphics software package
(2D design)

The logo being etched by the laser cutter

The logo being produce by the vinyl cutter

(1 – 2 marks)

16 marks

7 a Award one mark each for correctly identifying the correct tool:

SAW A	Jigsaw	<i>1 mark</i>
SAW B	Coping saw	<i>1 mark</i>

7 b Award up to **three** marks for details of a suitable process

Possible responses:

CUTTING A CURVED LINE

- A work piece clamped in a vice or onto a bench *1 mark*
- A curved line being cut *1 mark*
- A drawing of the blade/saw *1 mark*

CUTTING OUT AN INSET

- A work piece clamped in a vice or onto a bench *1 mark*
- An inset being cut out via a hole in the material *1 mark*
- A curved line being cut *1 mark*
- A drawing of the blade/saw *1 mark*

Changing the blade

- Loosening the blade *1 mark*
- Inserting the blade *1 mark*
- Tightening the blade *1 mark*

7 c Award up to **four** marks for a suitable detailed explanation.

Possible responses:

- When a blade wears out it can be replaced
- When a blade breaks/bends it can be replaced
- It saves time as the saw is always being used with an efficient blade
- It saves money as the user doesn't need to replace the whole tool
- It saves the environment as the cost to the environment of replacing a blade is far less than replacing the whole tool
- It improves the sustainability of the tool
- You can use different blades for different materials/processes *4 marks*

- 7 d** Award up to **six** marks for a suitable detailed answer.
Although these responses deal with the advantages of using the saws, candidates may correctly refer to the disadvantages

Coping saw

Possible responses:

- Lighter than the jigsaw
- Easier to handle
- Better control
- Less expensive to buy
- No power source required
- Safer to use
- Environmentally friendly

Jigsaw

Possible responses:

- Cuts much quicker
- Less effort required
- Greater variety of blades available
- Will cut a wider variety of materials
- Requires a power source
- Better ergonomic styling
- More comfortable to use
- Safer has guards/soft grip/dust extraction
- Accurate with a guide

6 marks

15 marks

8 Award **two** marks for details relating to the property of the material and one mark for a suitable specific use.

Material	Property	Use
Thermo chromatic plastic	<p><i>Award up to 2 marks for any of the following</i></p> <p><i>This plastic will change colour when its temperature is altered.</i></p>	<p><i>A kettle</i> <i>A babies feeding spoon</i> <i>A thermometer</i></p> <p><i>(1 mark)</i></p>
Carbon Fibre	<p><i>Award up to 2 marks for any of the following:</i></p> <p><i>This composite material is lightweight, strong, tough, durable and resistant to corrosion. Comes on a roll.</i></p>	<p><i>Crash helmets</i> <i>Car body panels</i> <i>Tennis racquet</i> <i>Bike frames</i></p> <p><i>(1 mark)</i></p>
'Polymorph'	<p><i>Award up to 2 marks for any of the following:</i></p> <p><i>This modern material can be easily moulded with the application of warm water/hot air. It is strong, durable and resistant to corrosion.</i></p>	<p><i>Ergonomic models</i> <i>Handles</i> <i>Prototypes</i></p> <p><i>(1 mark)</i></p>
Motion control gel 'Smart grease'	<p><i>Award up to 2 marks for any of the following:</i></p> <p><i>This gel has a high viscosity and lubricates. This controls the speed at which the mechanism moves.</i></p>	<p><i>Drawer runners</i> <i>Spectacle cases</i> <i>Toilet lids</i> <i>CD draws</i></p> <p><i>(1 mark)</i></p>

12 marks

9 a Award one mark for correctly identifying the glue

Possible responses:

- Epoxy resin (Araldite)
- Contact Adhesive
- Super glue
- No nails

Not PVA and Tensol cement

1 mark

9 b Award 1 mark for any of the following

This can be marked as correct even if the answer to 9a is wrong

Possible responses:

- It will glue different materials together
- It is a strong glue
- It dries clear
- It's quick drying
- It doesn't need clamping

1 mark

9 c Award up to two marks for details of a relevant safety precaution.

Possible responses:

- Avoid contact with your skin
- Wear gloves
- Apply with a spatula
- Avoid contact with the eyes
- Wear goggles
- Wear an apron
- Avoid inhalation
- Use in a well ventilated room
- Environmental issues/safe disposal

2 marks

- 9 d** Award up to 5 marks for details of the gluing process
Answers may be in note and/or sketch form
Look for the following details

Epoxy resin

- Key both surfaces with an abrasive paper
- Ensure that both surfaces are clean and free from dust.
- Squirt equal amounts of glue and hardener out of the tubes
- Mix thoroughly together
- Mask area
- Apply with a spatula
- Clamp
- Wipe off excess
- Leave to dry

Contact adhesive

- Key both surfaces with an abrasive paper
- Ensure that both surfaces are clean and free from dust
- Apply thinly, to both surfaces, with a spatula
- Leave to dry
- Press both surfaces firmly together

Super glue/No nails/PVA

- Key both surfaces with an abrasive paper
- Ensure that both surfaces are clean and free from dust
- Apply thinly, to one surface
- Press both surfaces firmly together
- Leave to dry

5 marks

9 marks

- 10 a** Award **one** mark for **each** relevant type of research.
Award one mark for each correct explanation

Possible responses:

- Carry out a questionnaire – to gain information from the target market
- Use books – to gain information
- Use the Internet – to gain information
- Carry out a product analysis of an existing computer workstation – to gain information on the types of material, construction methods and ergonomic features
- Carry out market research – to find what designs are already being sold
- Measure the various pieces of computer equipment that are to be housed in the computer workstation – to ensure that it will hold everything
- Research anthropometric data – to ensure that it will be the correct size for the target market
- Research materials – to ensure that the materials will be strong enough and suit the design
- Research construction methods – to ensure that the materials will be fixed together securely
- Research finishing techniques – to ensure that the material will look good and be durable

(4 x 1 mark)

- 10 b** Award up to four marks for a suitable explanation.

Possible responses:

- To prevent others copying their idea
- Ideas have a value
- By protecting your idea you will receive all the money from their idea
- Designers will take out a patent/copyright
- Patents/copyright can be sold
- Patents/copyright are legal document

(4 x 1 mark)

- 10 c** Award up to four marks for a suitable detailed explanation.

Possible responses:

- The manufacturer will use quality control techniques at every stage of manufacture e.g. templates /jigs/formers/checking/sample
- The manufacturer may use CAD to design their product. This is more accurate and consistent than traditional methods of drawing.
- The manufacturer may use CAM to produce their product. This is more accurate and consistent than

traditional methods of manufacture.

- The manufacturer will use high quality materials
- The workstation will be tested to ensure that it is safe to use
- The workstation will be tested to ensure that it is functional
- The workstation may have 3rd party testing. (BSI)
- Package and store the product safely and securely

(4 x 1 mark)

12 marks

- 11** Look for details relating to the advantages and disadvantages of using CAM:

Mark the candidates work based on its technical merit. Then assess it for its QWC and increase/decrease the mark by up to 2 marks.

Advantages

- Quicker machining time
- Safer to use
- Greater consistence
- Greater accuracy
- Cost effective when manufacturing in large quantities
- Less workforce required

Disadvantages

- High initial set up costs
- Staff require retraining
- Higher energy costs
- Not cost effective for manufacturing in small quantities

A fully detailed and comprehensive response that includes details of all 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.

(9 – 10 marks)

A fully detailed and comprehensive response that includes details of most 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.

(7 – 8 marks)

A detailed and comprehensive response that includes several 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.

(5 – 6 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. (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)

10 marks