GCSE

DESIGN AND TECHNOLOGY RESISTANT MATERIALS TECHNOLOGY

45601

Mark scheme

4560
June 2014

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

Section A

1 *Give **three** design requirements of the games console storage device.*

Explain each of your answers.

An example has been completed for you.

Requirement: The device should protect the games console and other items.

Explanation: This will prevent the games console and other items from getting damaged.

(Max 6 marks)

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

Award 1 mark for a correct Requirement and 1 mark 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. Candidates should **not** be awarded a mark if they simply repeat information given in the brief or in the given example.

Any **three** correctly identified requirements.

Possible responses:

1. Must be soundly constructed
2. Should organise the items
3. Should be capable of being manufactured in quantity
4. Must be safe to use
5. Must be ergonomically designed
6. Must be durable
7. Must be compact
8. Must be stable
9. Must be aesthetically pleasing (stylish) (3 x 1 marks)

Any **three** relevant explanations

Possible responses:

1. The device should not break when in use
2. This will make finding the items easy
3. Making things in bulk reduces the unit cost
4. No one should be injured when using the device
5. It should be easy and comfortable to use
6. It should withstand everyday use
7. It should not take up too much room on the table
8. The device should not topple over
9. This will increase it saleability (3 x 1 marks)

2 *Study the information given in the **Design Brief** (page 2) and your **Design Specification** (page 3).*

(Max 15 marks)

2 (a) *Use this information to help you sketch **three** different ideas for a device that will store/hold a games console and games.*

Marks will be awarded for creativity.

(3 x 3 marks)

Note: If all designs appear on one page then full marks can still be awarded.

Mark each idea out of 3 using the following scale:

- A repeat idea — *0 mark*
- A simple idea that stores/holds a games console and games. e.g. geometric boxes — *1 mark*
- An idea that stores/holds a games console and games. It displays some originality or additional design features. e.g. a multi-level design, racks and holders — *2 marks*
- An original idea that stores/holds a games console and games. It displays several creativity design features and ergonomics has been considered. — 3 *marks*

Exemplar material on next page 5

2 (b) *Use this information to help you sketch **two** different ideas for a device that will store/hold a games console, games and other games equipment.*

Marks will be awarded for creativity.

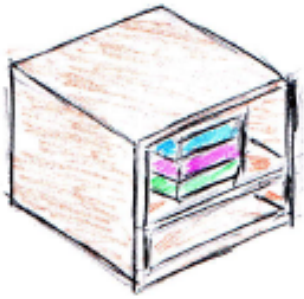
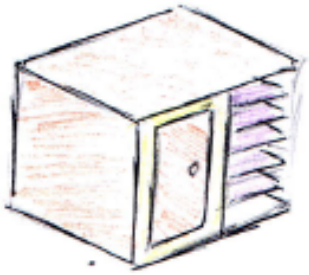
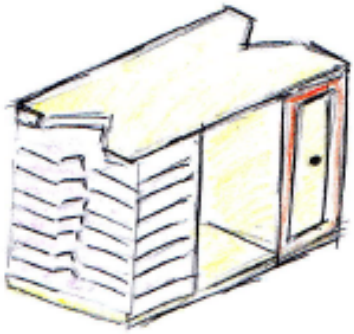
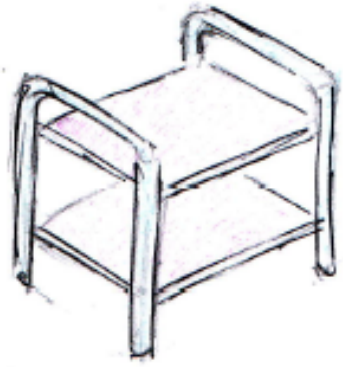
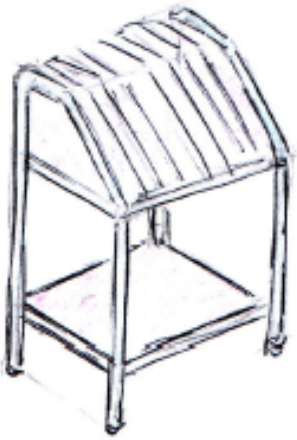
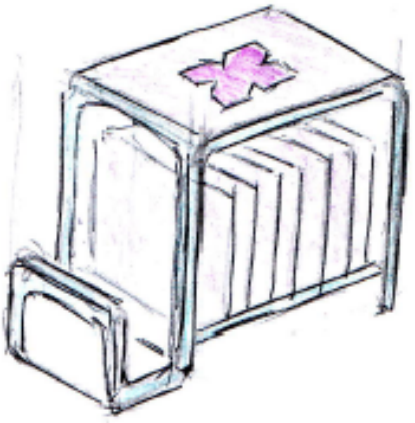
(2 x 3 marks)

Mark each idea out of 3 using the following scale:

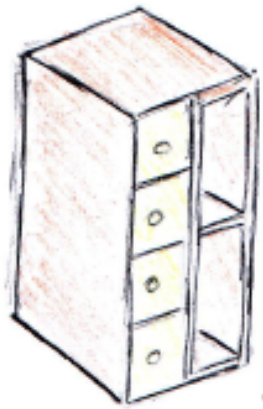
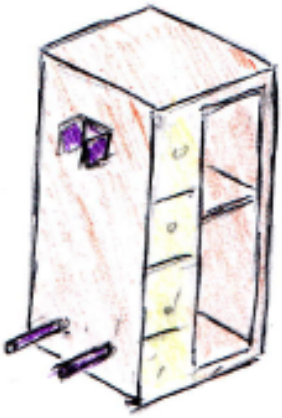
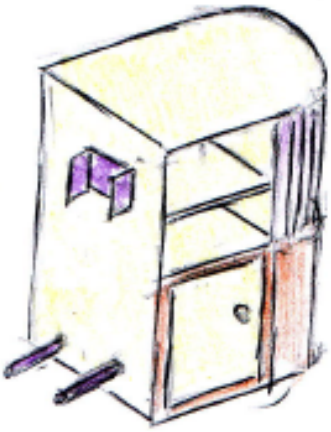
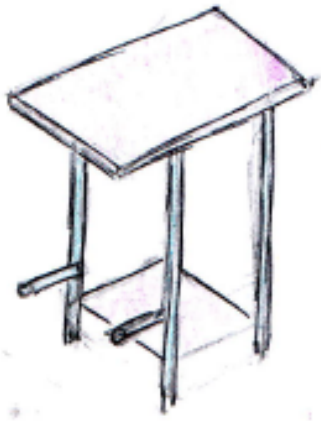
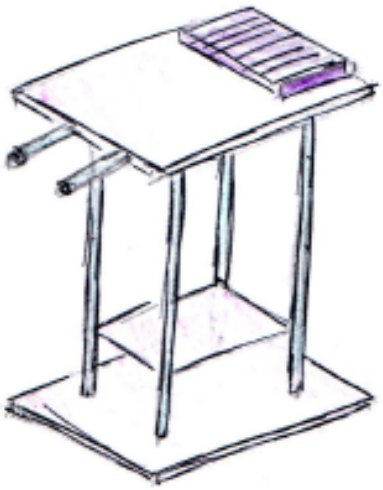
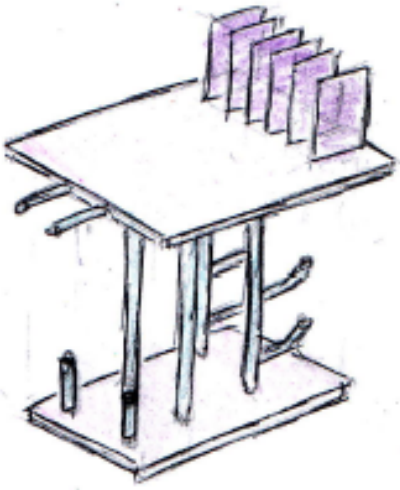
- A repeat idea — *0 mark*
- A simple idea that stores/holds a games console, games and games equipment. e.g. geometric boxes — *1 mark*
- An idea that stores/holds a games console and games and games equipment. It displays some originality or additional design features. e.g. a multi-level design, racks and holders — *2 marks*
- An original idea that stores/holds a games console games and games equipment. It displays several creative design features and ergonomics has been considered. — 3 *marks*

Exemplar material on next page 6

Q2a Exemplar answers – A device that stores a games console and games

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
		
		

Q2b Exemplar answers– A device that stores a games console, games and other games equipment

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 your best idea from Question 2.*

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

Marks will be awarded for:

- *details of materials and finishes (explain your choices)* *(3 marks)*
- *constructional details* *(3 marks)*
- *design features and sizes.* *(3 marks)*

(Max 9 marks)

Development details could include:

Materials and finish

One or more specific material(s) and one or more relevant finish(es) identified and **both** justified.	3 marks
One or more specific material(s) **or** one or more relevant finish(es) identified and only **one** justified	2 marks
One or more specific material(s) **and** one or more finish(es) identified.	1 mark
If only a material or only a finish is given.	0 marks
Generic materials (wood, metal plastic) and/or an inappropriate finish	0 marks

(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 (e.g. ergonomic features, holding methods, aesthetic features.)
Award one mark for two or more dimensions

Note: If just numbers are used to indicate size assume they are in mm.
Allow imperial measurements

(Max 3 marks)

4 *Question 4 is about evaluation.*

You should spend about 3 minutes on this question.

Evaluate your developed design (Question 3) against your design requirements (Question 1).

(Max 3 marks)

Note; The candidate can still be awarded marks even if they have used different requirements than they stated in Q1.

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

Comments must be justified to be awarded mark**.**

Look for qualifying connecting words such as those highlighted below.

1. The design is durable as it has been manufactured in polypropylene
2. The design organises the games using the rack
3. The design is capable of being manufactured in quantity by injection moulding

3 x 1 mark

5 *Use notes and sketches to show how you would make a batch of **ten** note pad holders in a school workshop.*

*At each stage, name **all** the tools, equipment or software you would use.*

(Max 14 marks)

Candidates can gain marks even if they have answered in the wrong boxes.

Award marks using the following descriptors

Stage 1: Marking out (traditional)

1 - 2 marks

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

Look for details relating to use of:

Wood

- Pencil
- Rule
- Tri square

Metal

- Scriber
- Rule
- Engineer's square

Plastic

- Spirit based pen/pencil
- Rule
- Square

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

Look for details relating to the manufacture of template
Look for details relating to the use of a template

Or

Stage 1: Marking out (CAD)

Sufficient detail for the design to be drawn by CAD by a third party. Most tools, equipment/software 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*

Look for details relating to use of:

Wood

- Tenon/coping saw
- Drill
- Sandpaper

Metal

- Hacksaw/piercing saw
- Drill
- File

Plastic

- Tenon/coping saw
- Drill
- File

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

Look for details relating to use of:

Wood

- Band/'Hegner' saw
- Drill
- Disc sander/Band facer

Metal

- Guillotine/Bandsaw/Jigsaw/'Hegner' saw
- Drill
- File

Plastic

- Band/'Hegner'saw/jig saw
- Drill
- Disc sander/Band facer

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:

Transfer of data to CAM
Laser cutter/CNC router
Setting up the laser/holding/autofocus
Coloured lines
Power setting
Safety *1 – 4 marks*

Stage 3: Bending/forming/casting/moulding/rapid prototyping the note pad holder

Sufficient detail for some of the design to be bent/formed by a third party as a **one off**. Most tools and equipment given

Look for details relating to the making of:

Wood

- Bending, laminating (without a former)
- cutting from solid

Metal

- Simple bending (without a former)

Plastic

- Line bending/oven bending/heat gun (without a former) *1 – 2 marks*

Sufficient detail for most of the design to be bent/formed by a third party, in quantity, using **formers/moulds**. Most tools and equipment given.

Wood

- Laminating
- Bag press
- Steam bending

Metal

- Bending (with a former)
- Casting

Plastic

- Line bending/oven heating/heat gun (with former)
- Rapid prototyping

3 - 4 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

Application of varnish/paint/

Or

1 - 2 marks

Stage 4: Applying the surface finish (CAM)

Reference to the fact that a laser cut stand 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, metal polish 'Brasso' and polishing/buffing.

1 - 2 marks

Mark Scheme

Manufactured board	Name
	Plywood/multiply *(1 mark)*
	Chipboard *(1 mark)*

6 (b) *Give **three** advantages of using MDF (Medium Density Fibreboard) instead of solid, natural timber.*

(Max 6 marks)

Use the following criteria to mark questions 6 (b) (i), (b) (ii) and (b) (iii).

Award one mark each, for an advantage of using MDF**.**

Possible responses:

- MDF is available in large sheets
- MDF has a smooth surface
- MDF is an environmentally friendly/sustainable material
- MDF is a stable material
- MDF is cost effective (cheap)
- MDF does not have knots/defects
- MDF can accept a veneer/'formica' finish

(3 x 1 marks)

Award one mark each a suitable explanation**.**

- Therefore you can create much large surface areas
- So there is no need for planing and sanding
- It can be made from waste or recycled wood
- It will not warp or twist
- Therefore products will be less expensive

- Therefore the product will be stronger and will not require any additional treatment
- Therefore its appearance and properties can be altered.

(3 x 1 marks)

6 (c) *Discuss the possible environmental impact of using MDF (Medium Density Fibreboard).*

Include information on sourcing the raw material, the manufacture of the board and the end of the product's life.

(Max 10 marks)

Award marks for details relating to the environmental impact of using MDF. Candidates may qualify each of these points and gain extra marks

Possible responses:

- MDF is made from wood
- Wood is a renewable resource
- MDF can be made from recycled wooden products
- MDF can be made from parts of the tree normally thrown away
- The process of manufacturing MDF uses fossil fuels
- Fossil fuels are a finite resource
- The burning of fossil fuels damages the environment
- MDF is manufacture using adhesives that are not environmentally friendly
- MDF needs to be transported using vehicles that cause pollution
- MDF products can be recycled at the end of their life

(10 x 1 mark)

7 (a) *Complete the table shown below.*

(Max 10 marks)

Name	Modelling properties	Image
Paper/cardboard *(1 mark)*	Easy to cut with scissors. Easy to fold into a 3D object. Easy to glue.	
Polymorph	A plastic (polymer) that is easy to form/reform into an ergonomic shape. *(1 mark)* Using hot water *(1 mark)*	
Construction kits	Very quick to assemble into a 3D model. Gives a solid rigid shape *(1 mark)* Can be reused/modified. *(1 mark)*	
Balsa	A soft hardwood that can be easily cut using a craft knife. (1 mark) Can be quickly assembled into a 3D model using glue. *(1 mark)*	
Modelling board/thin manufactured board *(1 mark)*	Can be easily cut Easy to construct into a 3D model. *A cost effective material* *Max (2 marks)*	

7 (b) *Explain why designers will make models of their ideas during the design process.*

(Max 4 marks)

Award one mark each for any of the response shown below.
Award a second mark for a qualification
Do not accept 'Cheap'

Possible responses:

- To show the client the idea
- To test the idea works
- To test to see if the idea is safe
- To see what the idea looks like in 3D
- The materials cost less
- It is quicker to produce

4 x 1 mark

7 (c) *Designers can make use of CAD (Computer Aided Design) software to produce virtual models of their designs.*

Explain the advantages and disadvantages of using CAD (virtual) modelling instead of traditional modelling techniques.

You will be assessed on Quality of written communication in this question.

(Max 8 marks)

Award marks for details relating to advantages and disadvantages of using CAD as a modelling technique.

Candidates can get one mark for stating an advantage/ disadvantage and a second mark for explaining the advantage/disadvantage.

Possible responses:

Advantages

- It is quick to produce a virtual 3D model/therefore saving time and money
- It can be easily modified/therefore you do not need to redraw the design if you wish to make a change
- It can be rendered to look like it is made in any material/so you can quickly visualise how will look if made from a variety of materials
- It can be emailed anywhere in the world/saving the time and expense of postage
- It can be transferred to manufacture/saving time and money
- It can be shared instantly with the client/reducing the time it takes to get a successful design

Disadvantages

- The initial set up cost is expensive/both the hardware and design software are expensive
- If there is a technical fault all your work can be lost/computers can fail and this would be costly in terms of time and money
- Your idea can be hacked/computers can accessed by other people and ideas stolen
- You need good IT skills to design in 3D/this main involve employing a different workforce or retrain the existing workforce.

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*

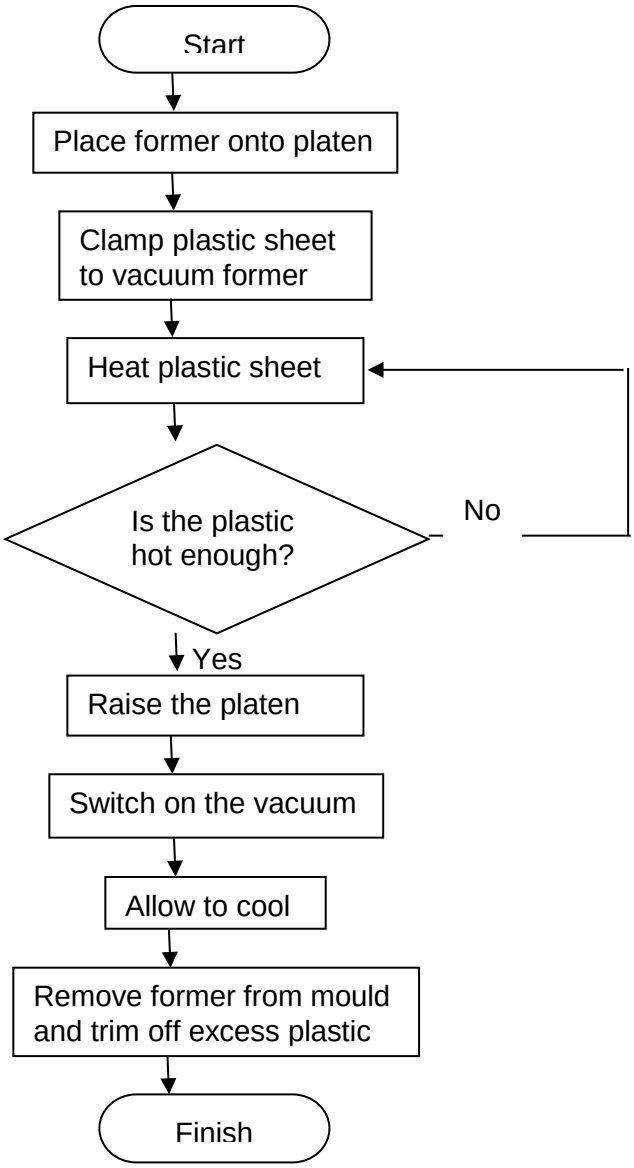
Mark scheme

8 Use the next page to produce a flow chart clearly describing the process of vacuum forming the coffee cup lid shown below.

(Max 10 marks)

- Award 1 mark for 5 correct stages of the vacuum forming process. The stages must be in the correct order.
- Award up to 2 marks for the correct use of process boxes
- Award 1 mark for the addition of flow arrows
- Award 1 mark for the correct use of a decision box.
- Award 1 mark for a return arrow

Possible responses:



9 (a) Identify which of the following correctly describes “market-pull”.

Award one mark for a tick placed in the correct box. If more than one box is ticked than no marks can be awarded

If a candidate ticks more than 1 box no marks can be awarded

Description	Tick
There is a public demand for a product to be designed and made	✓
A material that has a high tensile strength	
An entrance to a shopping centre	

(1 mark)

9 (b) Identify which of the following correctly describes “technology-push”.

Award one mark for a tick placed in the correct box. If more than one box is ticked than no marks can be awarded

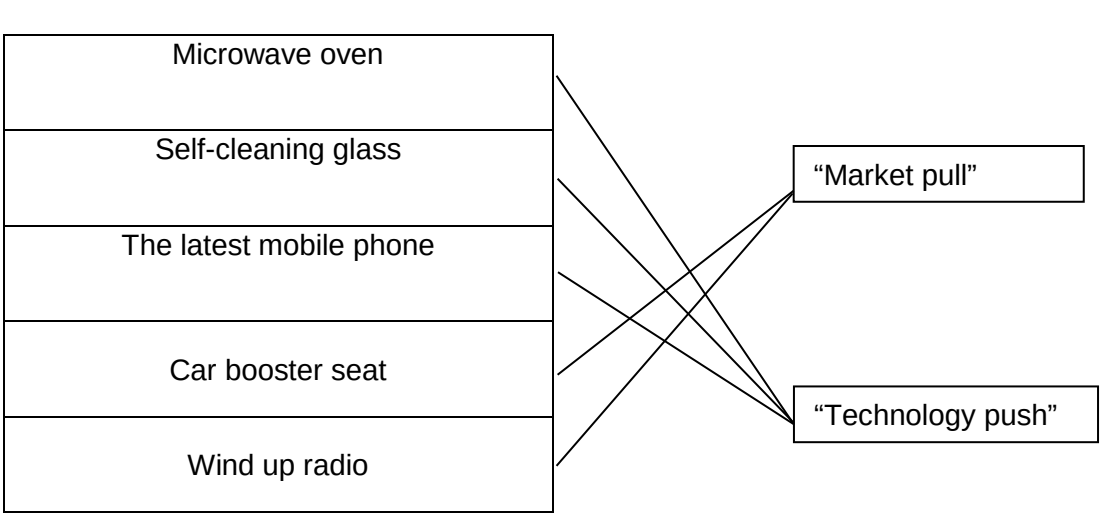
Description	Tick
Old products are made obsolete	
Advances in technology enable new products to be designed and made	✓
A material that has a high compressive strength	

(1 mark)

9 (c) On the diagram below, use straight lines to link the products to the correct category.

(Max 5 marks)

Award one mark each for a correct link. Line, shape, size and/or colour of is irrelevant.



10 (a) Identify and describe **two** features of the electronic toothbrush that show that the designers has thought about product maintenance.

(Max 4 marks)

Award one mark each for a correctly identified feature and a suitable description.

Possible responses:

Feature	The brush heads
Description	They can be replaced by pulling them off the main body
Feature	The battery
Description	It can be recharged
Feature	The battery level indicator/digital screen
Description	Tells you how much power you have left in the battery
Feature	The toothbrush and charger are made from plastic
Description	They can easily be wiped clean

4 x 1 mark

10 (b) *Explain why it is important for a designer to think about maintenance when designing products.*

(Max 4 marks)

Award up to four marks for an explanation of why it is important for a designer to think about maintenance when designing products.

Possible responses:

- It extends the life of the product
- You don't have to buy a new product when a part is worn out or fails
- You can keep the product in optimum working order
- A product in optimum working order is more efficient
- It is cost effective
- You don't have to buy a complete new product
- It increases the sustainability of the product
- It is environmentally friendly
- It ensures that the product will be safe to use

4 x 1 mark

10 (c) *Explain why the designer has used ABS plastic in the manufacture of the toothbrush.*

(Max 4 marks)

Award up to four marks for an explanation of how the designer has thought about the materials used.

Possible responses:

Single word statement 'strong/cheap' cannot be awarded a mark

ABS is tough material that will withstand normal use as a toothbrush and being dropped onto the floor.
ABS is hygienic as can be easily cleaned
ABS is waterproof and therefore the electrical components will not get wet
ABS is suited to mass production techniques such as injection moulding
ABS can be easily moulded into an ergonomic shaped
ABS is self coloured
ABS is self-finished
ANS is a non-toxic material

4 x 1 mark

10 (d) *Use notes and sketches to clearly show **one** method that the designer could have used to enable easy access to the battery compartment.*

(Max 4 marks)

Award marks for details of a method that the designer could have used to enable easy access to the battery compartment.

A fully detailed response clearly showing a method of quickly accessing the battery compartment.	*3 – 4 marks*
A simple explanation of how the battery compartment could be accessed.	*1 – 2 marks*

Possible responses:

- Lens screwed to battery compartment
- Battery compartment screwed to lens
- Lens clipped onto battery compartment
- Sliding access panel on battery compartment
- Hinged access panel on battery compartment