Oxford Cambridge and RSA Examinations

RECOGNISING ACHIEVEMENT

GCSE IN ENGINEERING: DOUBLE AWARD **1492**
GCSE IN MANUFACTURING: DOUBLE AWARD **1496**

ADDITIONAL SPECIMEN ASSESSMENT MATERIALS

This document contains specimen assessment materials for the GCSE's in Engineering and Manufacturing. These further specimen questions reflect those found in the original specimen paper (available with the specifications) and are to be used as further practice questions by candidates. They must only be used in conjunction with the original specimen assessment materials which give a guide to the general shape and character of the operational examination paper.

QAN 100/1969/8

CONTENTS

1 Select **four** sectors that you have studied from the lists below:

Manufacturing	**Engineering**	
biological and chemical	aeronautical	fluid
engineering fabrication	automotive	marine
food and drink	civil	mechanical
paper and board	computer	process control
printing and publishing	construction	telecommunications
textiles and clothing	electrical and electronic	

State a different example of a product manufactured within each of your chosen four sectors.

For each example describe **one** different technology used in the manufacture of the product.

(a) Sector:_____

Example product:_____ **[1]**

Technology used in manufacture:_____ **[2]**

(b) Sector:_____

Example product: _____ **[1]**

Technology used in manufacture:_____ **[2]**

(c) Sector:_____

Example product:_____ **[1]**

Technology used in manufacture:_____ **[2]**

(d) Sector:_____

Example product: _____ **[1]**

Technology used in manufacture:_____ **[2]**

2 (a) The stages in making a product are:

- production planning;
- assembly and finishing;
- packaging and despatch;
- design;
- processing – production; and
- .material supply and control.

Complete the links below to show the correct order in which the stages are carried out.
The first stage has been done for you.

1	Production planning
2	Assembly and finishing
3	Packaging and despatch
4	Design
5	Processing - production
6	Material supply and control

[5]

(b)

(i) State **two** activities carried out during the production planning stage.

1_____ **[1]**

2_____ **[1]**

(ii) State **two** activities carried out during the assembly and finishing stage.

1 _____ **[1]**

2_____ **[1]**

(iii) State **two** activities carried out during the material supply and control stage

1_____ **[1]**

2_____ **[1]**

(iv) State **two** activities carried out during processing - production

1_____ **[1]**

2_____ **[1]**

(v) State **two** activities carried out during the design stage.

1_____ **[1]**

2_____ **[1]**

(vi) State **two** activities carried out during the packaging and dispatch stage.

1_____ **[1]**

2_____ **[1]**

3 Modern and Smart materials are used to improve characteristics of products.
For example, they are used to:

- reduce the weight of a product;
- increase the strength of a product;
- make a product easier to produce;
- improve disposability of a product;
- improve reclaimability of a product
- make a product easier to use; or
- make a product safer.

a) Give **one** example of a modern or smart material used to reduce the weight of a product.

(i) Product _____ **[1]**

(ii) Material _____ **[1]**

b) Give **one** example of a modern or smart material used to increase the strength of a product.

(i) Product _____ **[1]**

(ii) Material _____ **[1]**

c) Give **one** example of a modern or smart material used to make a product easier to produce.

(i) Product

_____ **[1]**

(ii) Material _____ **[1]**

d) Give **one** example of a modern or smart material used to improve the disposability of a product.

(i) Product _____ **[1]**

(ii) Material _____ **[1]**

e) Give **one** example of a modern or smart material used to make a product easier to use.

(i) Product _____ **[1]**

(ii) Material _____ **[1]**

f) Give **one** example of a modern or smart material used to make a product safer.

(i) Product _____ **[1]**

(ii) Material _____ **[1]**

4 Complete the table below to show **two** examples of how ICT (Information and Communication Technology) can be used in **each** of the activities.

Activity	ICT	Examples of use
Product design	Spreadsheet	To calculate total cost to make one product
		To do a break even analysis to see if you will make a profit
Product design	CAD software	**[1]**
		[1]
Product design	Database	**[1]**
		[1]
Marketing	Internet	**[1]**
		[1]
Material supply and control	Internet	**[1]**
		[1]
Assembly	Control Technology	**[1]**
		[1]
Packaging & Dispatch	Database	**[1]**
		[1]

5 You have carried out simple assessments of product properties, for example:

- heaviness;
- scratch resistance;
- wear resistance;
- areas likely to be damaged; and
- structure.

a) Describe how you assessed a product's **heaviness.**

Product _____

Assessment carried out.

_____

_____ **[2]**

What you found out about the product's heaviness.

_____

_____ **[2]**

b) Describe how you assessed a product's **scratch resistance**.

Product _____

Assessment carried out.

_____

_____ **[2]**

What you found out about the product's scratch resistance.

_____

_____ **[2]**

c) Describe how you assessed a product's **wear resistance**.

Product _____

Assessment carried out.

_____

_____ **[2]**

What you found out about the product's wear resistance.

_____

_____ **[2]**

d) Describe how you assessed which areas of a product are **likely to be damaged.**

Product

Assessment carried out._____

_____

_____ **[2]**

What you found out about areas of the product that are likely to be damaged.

_____

_____ **[2]**

e) Describe how you assessed a product's **structure**.

Product _____

Assessment carried out.

_____

_____ **[2]**

What you found out about the product's structure.

_____

_____ **[2]**

6 Use sketches and notes to show how modern technology is used in the design and manufacture of a product you have studied. You should include:

- technology used; **[4]**
- materials and components used; **[4]**
- structure and form of the product; and **[4]**
- the purpose of the product. **[2]**

7 The table below shows engineering and manufacturing sectors.

Engineering Sectors		**Manufacturing Sectors**
Aeronautical	Fluid	Biological and Chemical
Automotive	Marine	Engineering Fabrication
Civil	Mechanical	Food and Drink
Computer	Process Control	Paper and Board
Construction	Telecommunications	Printing and Publishing
Electrical and Electronic	**---**	Textiles and Clothing

Choose **four** sectors and write the name of each sector in the table below.

Complete the table by:

- naming a typical product from each sector; and
- describing how modern technology has improved its key features

Sector	**Product**	**How modern technology has improved its key features**
1	**[1]**	……. ……. ……. **[2]**
2	**[1]**	……. ……. ……. **[2]**
3	**[1]**	……. ……. ……. **[2]**
4	**[1]**	……. ……. ……. **[2]**

8 Mobile phones have many benefits for their users. Some people argue that they cause problems to society.

a) Describe **two** potential problems to society when people use mobile phones.

1 _____

_____

_____ **[2]**

2 _____

_____

_____ **[2]**

b) Describe how **one** of the problems you have given in part **(a)** has been addressed by a manufacturer of mobile phones.

_____

_____ **[2]**

c) Describe how **one** of the problems you have given in part (a) has been addressed by a supplier of mobile phones.

_____

_____

_____ **[2]**

9 Modern and smart materials and components have had an impact on the range of products available.
These materials include:

- polymers;
- composites;
- biological and chemical,
- computer technology;
- micro-electronic; and
- textile technology.

Complete the table below to show how **one** example of each type of modern material has had an impact on the range of products available.

Modern/Smart material type	**Material example**	**How the material has had an impact on the range of products available**
Polymers	**[1]**	**[2]**
Composites	**[1]**	**[2]**
Biological or Chemical	**[1]**	**[2]**
Computer technology	**[1]**	**[2]**
Microelectronic	**[1]**	**[2]**
Textile	**[1]**	**[2]**

10 Computer Integrated Manufacturing (CIM) systems use ICT to link the following:

development	design	production planning
material sourcing and control	processing	assembly
finishing	packaging	and dispatch

a) Describe **six** benefits of using CIE/CIM rather than separate computers and automated equipment at each stage.

1 _____

_____

_____ **[2]**

2 _____

_____

_____ **[2]**

3 _____

_____

_____ **[2]**

4 _____

_____

_____ **[2]**

5 _____

_____

_____ **[2]**

6 _____

_____

_____ **[2]**

11 a) Stereo lithography is a process developed for making realistic models and working prototypes. Prototypes are built by scanning a laser across a vat of liquid resin. CAD data drives the laser which traces the 3D shape of the component, curing the resin as it goes. This produces a solid resin model exactly to the CAD drawing. Resin is a relatively soft material, with a low melting point compared to most metals.

a) Explain **two** possible benefits of using stereo lithography in developing product designs.

1 _____

_____

_____

_____ **[3]**

2 _____

_____

_____ **[3]**

b) Embedded computers are used in many products.

Explain, using **two** examples, how embedded computers are used in products

_____

_____

_____

_____ **[4]**

.Please note that the instruction ‘discuss’ means that you should:

- identify **three** relevant issues/points raised by the question;
- explain why you consider **two** of these issues to be relevant; and
- use **one** specific example or piece of evidence to support your answer.

12(a) Discuss the implications of using technology in relation to the working environment.

[6]

12(b) Discuss the implications of using technology in relation to sustainability.

[6]

Please note that the instruction 'discuss' means that you should:

- Identify **three** relevant issues/points raised by the question;
- explain why you consider **two** of these issues to be relevant; and
- use **one** specific example or piece of evidence to support your answer.

13(a) Discuss the implications of using technology in relation to the global environment.

[6]

13(b) Discuss the impact on the workforce of using technology.

[6]

Please note that the instruction 'discuss' means that you should:

- identify **three** relevant issues/points raised by the question;
- explain why you consider **two** of these issues to be relevant; and
- use **one** specific example or piece of evidence to support your answer.

14(a) Discuss the impact of systems and control technology on the range of products available

[6]

14(b) Discuss the impact of ICT on the range of products available

[6]

Please note that the instruction 'discuss' means that you should:

- identify **three** relevant issues/points raised by the question;
- explain why you consider **two** of these issues to be relevant; and
- use **one** specific example or piece of evidence to support your answer.

15 Discuss the impact of using technology on the availability of products.

[6]

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General Certificate of Secondary Education

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UNIT 3: Application of Technology

MARK SCHEME

Advice to examiners on marking scripts

1 Please ensure that you use the *final* version of the marking scheme. *You are advised to destroy all draft versions*.

2 Please mark all post standardisation scripts in red ink. A tick should be used for each answer judged worthy of a mark. The tick should be placed at the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks should never be used.

3 No comments should be written on scripts. Remember that scripts may be returned to Centres.

4 The marks awarded for each *part* question should be indicated in the margin provided on the right hand side of the page. The mark *total* for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5 Correct answers to calculations should gain full credit even if no working is shown unless otherwise indicated in the mark scheme. (An instruction on the paper to '*Show your working*' is to help candidates who may then gain partial credit even if their final answer is not correct.)

6 Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

7 An element of professional judgement is required in the marking of any written paper and candidates may not use the exact words that appear in the mark scheme. If the essence is correct *and* answers the question, contact your Team Leader/Principal Examiner for guidance.

Sample Answers:

Question	Answer	Mark	Grade
1	No marks for copying a sector 1 Mark for product clearly from identified sector. 2 for named technology (as in specification 1) relevant to stated product (1 mark only for generic answer e.g. robots or computers) For example: *Paper and Board* Product – packaging **(1)** Technology – automatic**(1)** printing of sell-by dates or batch numbers **(1)** *Mechanical* Product – screws**(1)** Technology – computer controlled weighing and packaging system**(2)** *Food* Product – bread Technology – automatic (1) temperature control in oven **(1)** *Textiles* Product – football strip Technology – modern material, breathable fabric **(2)** Automotive Product - Car **(1)** Technology – Robotic paint sprayer **(2)** aeronautical: Product – helicopter Technology – riveting of body panels Civil: Product – bridge Technology – CAD package to design and model performance Electrical and electronic: Product. walkman Technology – surface mounting of components on pcb Chemical and biological product - petrol Technology – distillation of crude oil to separate fractions	**4 x 1** **4 x 2**	G
2	**a)** links from top 2, 5, 6,**(1)** 4, 3 **b)** 1 mark for each of 2 activities appropriate to the stage of engineering or manufacturing. Examples: **i)** e.g. checking current orders and available resources (equipment, manpower, materials, services etc) **(ii)** e.g. bolting table legs to frame, adding end caps or placing filling into pastry case, moistening edge and applying pastry lid 2 x 1	**5** **2** **2**	G

	(iii) e.g. checking goods in against orders, contacting suppliers to check availability, or monitoring stock. And placing orders **(iv)** e.g. peeling and chopping vegetables, coating pills, weighing batches, mixing components, milling, etc. **v)** e.g. making a prototype, seeking users' views 2 x 1 **vi)** putting product and instruction booklet into carton then strapping shut or attaching destination barcoded labels to pallets, using fork lift to load pallets onto delivery vehicle.	**2** **2** **2** **2**	
3	1 mark for suitable product and 1 for appropriate specific material (accept generic with key property or where all examples would be appropriate) **a)** Product Tennis racquet Material carbon fibre reinforced resin **b)** Fireman's jacket Kevlar **c)** product: food preparation bowls high density polyethylene **d)** Product: shirt Lyocell fibre (breaks down into C02 and water) **d)** Product Baking tray. Material ptfe coating **e)** product: cool wall toaster expanded polymer for insulation	**2** **2** **2** **2** **2** **2**	F
4	One mark for each appropriate example (to 2) **<u>Product design-CAD software</u>** E.g. Prepare and change designs without redrawing Save designs as files to be used in manufacture **<u>Product design- Database</u>** E.g. Research – to find properties of materials Research – store information from surveys **<u>Marketing- Internet</u>** E.g. use websites like Google for advertising Carry out email surveys of customer satisfaction Have an online shop for customer orders **<u>Material supply and control- Internet</u>** E.g. order components online automatically Research suppliers of materials Check specifications of materials online **<u>Assembly- Control Technology</u>** E.g. pick and place machines for electronic components Robotics used on car assembly line **<u>Packaging & Dispatch - Database</u>** E.g. look up individual customer order details to pack correct items for dispatch Look up address for delivery on customer file to print label	**2** **2** **2** **2** **2**	F

5	No marks for the products, repeats OK. 2 marks for an appropriate assessment method (1 for simple point e.g. 'weighed it') 2 marks for sound conclusion (1 for simple point e.g.' it is heavy') e.g. **Product: Mobile phone** Tested heaviness by weighing it on kitchen scales It weighs about the same as an apple **Product: Mobile phone** Tested scratch resistance by sliding it down concrete ramp It got light scratches **Product: Mobile phone** Tested wear resistance by 21 people all pressed each button 20 times They still worked and were not worn down, could still read the numbers so the buttons are wear resistant. **Product: Mobile phone** Checked areas likely to be damaged visually then by dropping it to see how it landed The corners because it lands on them most and the finish scrapes off them and it dents and chips on concrete. **Product: Mobile phone** Took it apart to assess the structure. It is a shell structure with some ribs inside for strength.	 **2** **2** **2** **2** **2** **2** **2** **2** **2** **2**	E
6	Candidate's choice of product. The response should reflect the unit specification content. Guidance for marking **Technology used** clear indication of what utilised(1 each) and how incorporated(1each) into in the product to 4 marks. **Materials and components used** 1 marks for each specific material identified (NOT generic) , 1 for each component or ingredient, 1 for detail, 1 for clear indication of function in product. to maximum of 4 (see 8.2.4in specification) **Structure and Form** Up to 4 marks: One mark for a sketch or description of general form One mark for indicating each specific feature (structure or form) one for showing how that feature of the product meets its purpose/ reflects technology used Could be straightforward, e.g. Mobile phone **size**, **rounded corners** and **shell** structure reflect need to **keep in pocket** and **protect** delicate electronic components. **Purpose**: Two marks for a clear statement eg mobile phone to contact people on the move or	 **4** **4** **4**	D

	two points e.g. to send instant messages and to take photographs. One for simple broad statement e.g. to talk to your friends.	**2**	
7	**a)** no marks for the 4 sectors 1 mark for each appropriate product example 2 marks for the modern technology and improvement in each case. E.g. ***Paper and Board*** Product – packaging **(1)** Key feature – polymers e.g. expanded polystyrene allow protective packaging without greatly increased weight **(2)** ***Mechanical*** Product – food mixer**(1)** Technology – nylon bearings, quiet / reduced maintenance **(2)** ***Food*** Product – bread Technology – Extensograph measures the ability and resistance of a dough to stretching helps make consistent product ***Textiles*** Product – football strip Technology – modern material, breathable fabric improves comfort **(2)** **Automotive** Product - Car **(1)** Technology – Robotic paint sprayer for even finish **(2)** **aeronautical:** Product – Airbus A380 Technology – fly-by-wire system gives easier handling and enhanced safety **Civil:** Product – bridge Technology – CAD package to design and model performance **Electrical and electronic:** product – personal stereo Technology – surface mounting of components on pcb makes product more compact or mp3 technology means don't need tapes or CDs so much smaller. **Chemical and biological** product - petrol Technology – development of unleaded fuel formula to reduce environmental impact	**4 x 1** **4 x 2**	C
8	a)2 marks for each description of a potential problem to society of using mobile phones, with an example e.g.	**2 x 2**	C

	The signals could interfere with other equipment, for example life saving equipment in hospitals and navigation equipment in planes Phones ringing and people talking on them in public places can cause a nuisance to other people. The latest phones can be a target for thieves, which makes the user vulnerable to attack. One mark only for statement such as 'could get stolen' **b)** two marks for a description of how one of the problems described in a) can be addressed by manufacturers e.g. Designs allow phones to be set to silent mode. Develop systems that alert when a phone in use is taken into a hospital (reminder) or switched on in flight etc. One mark only for simple statement or for solution to problem not stated. **c)** two marks for a description of how one of the problems described in a) could be addressed by suppliers e.g. put pressure on manufacturers to modify the designs as above Security measures to make it difficult to use a stolen phone. E.g. blocking it when theft reported. One mark only for simple statement e.g. 'block it'	**2** **2**	
9	1 mark for a specific example of the material group 2 marks for considered statement on the impact on product range. E.g. **Polymers** Polyethylene. Kitchenware - Inexpensive unbreakable waterproof, self coloured and injection moulded into a various shapes. **Composites** Chipboard. Inexpensive self assembly furniture in a wide range of styles. **Biological** Enzyme additives – introduction of low temperature washing powders, so washing machines have cool programmes to suit. Chemical Synthetic dyes for textiles increase the range of colours for furnishings, car upholstery etc **Computer –microprocessor** Advent of the electronic calculator **Micro electronic components:**	**6 x 3**	B

	LCD displays – incorporated into a wide range of consumer products from calculators to ipods. **Textiles** Liquid crystal coated fabrics- innovative products such as fabric displays, foldable keypads.		
10	2 marks for each benefit explained (accept giving similar benefits for different stages, but 1 mark only for generic such as improves efficiency in. No repeats) e.g. Improve product quality because there are no errors in transferring design information to production. Minimise manufacturing costs so can lower product costs and attract new customers Reduce product development time to maintain a competitive edge in the marketplace. Allows customisation or changes to specification by changing one (design) file only. Use materials/people/machinery more efficiently because production planning informed by current information about performance, so need less 'slack' in system. Less paper transfer of information with products so none gets lost. Barcoding of products / batches allows order tracking throughout the production process. Fewer people chasing progress/ meeting to exchange information between departments, so they can focus on production Less machine downtime because all machines are monitored and maintenance is planned at the same time for minimum disruption to schedule.	**6 x 2**	A
11	**a)** 3 marks for each clear explanation of a benefit of stereolithography. E.g. Saving time**(1)** by avoiding the need for a full mock-up **(1)**before a prototype is made**(1)** allowing sub assemblies to be tested **(1)** to make sure they work together**(1)** before final manufacture**(1)** allowing improved components to be compared with existing ones for fit or ease of use. Reduced costs **(1)** compared with hand-crafted methods**(1)** for producing small runs and one-offs**(1)** Can be used to produce resin formers**(1)** to make metal prototypes**(1)** so that component strength can be assessed**(1)** **b)** 4 marks for main points: it's a processor, pre-programmed to provide functions and giving 2 examples. e.g. Embedded computers usually are pre-programmed microprocessors that replace electronic elements in products. By using processors with different	**2 x 3** **4**	A

	programs, a range of product features can be enabled. For example all of a new range of cameras may contain the same basic components, but have different functions. Cars can have the same basic wiring, but individual models' functions are enabled by the embedded computer.		
12a	3 marks for raising 3 relevant issues **(I)** 2marks for stating why 2 of these are relevant **(R)** 1 for giving an appropriate example **(E).** Technology has affected Health and Safety in the working environment. Dust extraction equipment makes the air safer to breathe **(I).** Controlled conveyors can be used to move heavy or hazardous materials **(I),** this reduces the risk of injury to workers through straining their backs carrying heavy loads **(R).** Automated production equipment can increase noise in the working environment **(I),** this can be hazardous because workers hearing may be damaged **(R)** and also they may risk accidents because they may not hear a forklift truck approaching **(E).** Other points could be: Working on a production line can make a more stressful working environment **(I)** because workers have to keep up with the line**(R).** Automated production equipment can make the working environment hotter (I) which can be uncomfortable for workers**(R).** Adjustable workstations **(I)** in electronics assembly allow workers to change the height and angle of their seat and the height of their workbench **(E)** so they do not strain their back**(R).**	**3 x 1** **2 x 1** **1**	A*
12b	Allocation as in **12a)** E.g. Technology has developed new ways to recycle products **(I)** which makes them sustainable **(R),** such as making fleece fabric from old cola bottles **(E).** Modern biological washing powders work at lower temperatures **(I)** which makes washing more energy efficient **(R).** Chipboard is made from both recycled wood and replenishable wood All of the tree can be used, there is little waste **(I)**). Other points could relate to: using innovative materials as replacement for scarce natural resources product recovery / recycling energy efficiency systems	**3 x 1** **2 x 1** **1**	A*

13a	Allocation as in 12a) E.g. Modern polymers have been developed that do not use limited global resources **(I)** e.g. biopol (polyhydroxybutrate) made from vegetable sugars not fossil fuels **(R)** which is used for shampoo bottles **(E).** Modern methods allow resources to be used more efficiently(I) by reducing waste, using less energy and materials **(R)** These methods may also reduce costs and prices to consumers **(I)** which may encourage more consumption**(R).**	**3 x 1** **2 x 1** **1**	A*
13b	Allocation as in **12a)** E.g. Technology may result in workers being retrained to do more highly skilled jobs **(I)** while machines carry out routine tasks. This may mean they are paid better **(R),** but some workers will lose their jobs **(I).** For example cars are now produced with 1/20th of the workforce required 50 years ago **(E).** Technology may make working conditions safer for the workforce **(IR)** because they are no longer required to work in hazardous conditions**(I)** Workers may find their work less rewarding **(I)** because they can't take pride in a job done by a machine when they have only pressed a button**(R).** or because they don't have decisions to make so they don't feel important. **(R)**	**3 x 1** **2 x 1** **1**	A*
14a	Allocation as in **12a)** E.g. Using systems and control technology for example computer integrated manufacture **(I),** products can be developed and improved by making changes to a CAD file which is then sent directly to manufacturing**(R)** In a similar way, customised products can be produced to order**(I)** Some modern products could not be made without control technology**(I),** so they would not exist **(R),** for example applying elastic to some garments can only be achieved by specialist computer controlled machines**(E)** Embedded computers allow products to have a wide range of features **(I),** for example digital cameras have different programs installed for each model, but otherwise are mostly identical**(R).**	**3 x 1** **2 x 1** **1**	A*
14b	Allocation as in **8a)** E.g. the range of products can be increased by improving and developing existing products **(I).** If	**3 x 1** **2 x 1** **1**	A*

	ICT has been used to create designs using Computer aided Design **(I),** then amending the design files is easy compared with redrawing them manually**(R).** Because changes can be made quickly, companies can afford to make them and the range of products grows. **(R).** Companies can also respond quickly to market research**(R)** and may develop their product range for this reason. Because the internet has opened up worldwide markets **(I),** companies can access materials and components readily to use in their products**(R).** They may also decide to increase their range of products to appeal to different world markets**(R).** For example by producing right hand drive cars **(E).** another example Coca Cola has different amounts of sugar and fizz in different areas(E)		
15	Allocation as in **12a)** E.g. Suppliers' computer databases store sales information **(I)** which can be analysed to show when product stocks are running out so that they stay available to customers **(R)** Some suppliers use this information to keep stocks low so that consumers will pay more for a scarce product **(I).** On-line ordering on the internet **(I)** has made products available to purchasers across the world **(R)** for example the i-pod shuttle was available in America for 2 months before launch in UK **(E).**	**3 x 1** **2 x 1** **1**	A*