

**Applied Engineering (Double Award)  
Applied Manufacturing (Double Award)**

General Certificate of Secondary Education **GCSE 1492**

General Certificate of Secondary Education **GCSE 1496**

**Mark Schemes for the Units**

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**June 2007**

**1492/1496/MS/R/07**

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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**Mark Scheme 4868/4880**  
**June 2007**

## INSTRUCTIONS ON MARKING SCRIPTS

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### 1 Before the Standardisation Meeting

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The selection should be drawn from several Centres. The preliminary marking should be carried out **in pencil** in strict accordance with the mark scheme. In order to help identify any marking issues which might subsequently be encountered in carrying out your duties, **the marked scripts must be brought to the meeting.** (*Section 5c, page 6*)

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- a) Scripts must be marked in **red**, including those initially marked in pencil for the Standardisation Meeting.
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- c) **Annotation of scripts**

The purpose of annotation is to enable examiners to indicate clearly where a mark is earned or why it has not been awarded. Annotation can, therefore, help examiners, checkers, and those remarking scripts to understand how the script has been marked.

#### **Annotation consists of:**

- the use of ticks and crosses against responses to show where marks have been earned or not earned;
- the use of specific words or phrases as agreed at standardisation and as contained in the final mark scheme either to confirm why a mark has been earned or indicate why a mark has not been earned (eg indicate an omission);
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**d) Recording of marking: the scripts**

- i) Marked scripts must give a clear indication of how marks have been awarded, as instructed in the mark scheme.
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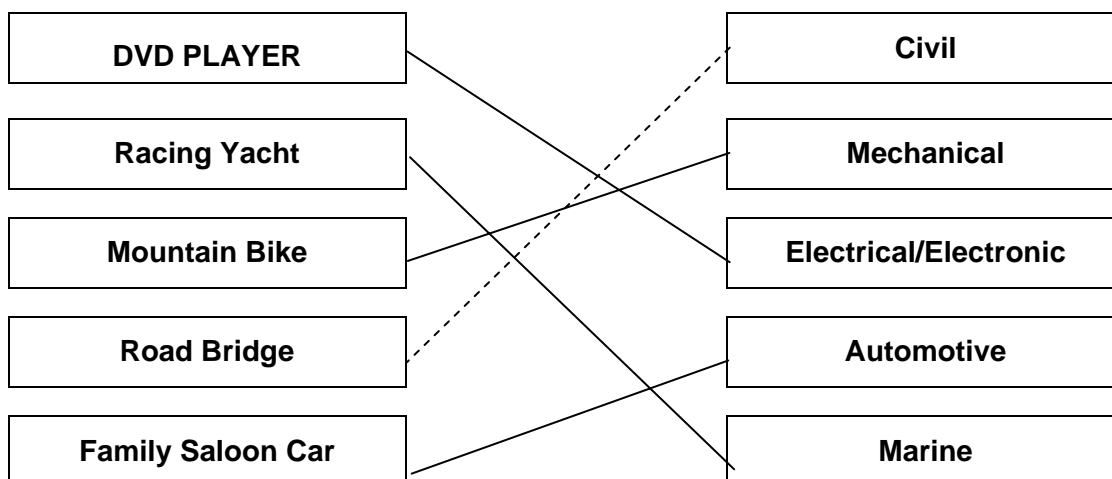
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The Standardisation Meeting will include a discussion of marking issues, including:

- a full consideration of the mark scheme in the context of achieving a clear and common understanding of the range of acceptable responses and the marks appropriate to them, and comparable marking standards for optional questions;
- the handling of unexpected, yet acceptable answers. (*Section 6a, bullet point 5, page 6*)

There will be times when you may not be clear how the mark scheme should be applied to a particular response. In these circumstances, a telephone call to the Team Leader should produce a speedy resolution to the problem. (*Appendix 5, Para 17, page 26*)

1 (a)



[4]

1 mark per correct link. Do not reward the point which has been given (dotty line).

(b) **Products must be listed in part (a)**  
**Accept generic response eg 'robotics' once only**

The technology must be used by the product and not in the manufacture of the product.

Old technology can be rewarded if there is no new technology stated and vice versa. Do not reward old technology if it does not relate to the suggested new technology.

Racing Yacht

New technology: Aluminium or glass/carbon fibre Hull, G.P.S., self steering mechanism, speed winches, sail technology (shape & materials), nylon ropes and lines.

[1]

Old Technology: Wooden or steel hull, radio compass, cotton/canvas sails, Old style navigation equipment.

[1]

Mountain Bike

New Technology: Carbon fibre frames, multi speed gearing systems, hydraulic disc brakes, hydraulic/pneumatic suspension systems.

[1]

Old Technology: Low carbon steel or aluminium frames, hard rubber brake blocks (side pull), little or no suspension damping, limited gearing systems.

[1]

Road Bridge

New Technology: Carbon fibre reinforced cables on suspension towers. Long span suspension design. Cable stay design (2nd Severn crossing)

[1]

Old Technology: High carbon steel cables on towers. Cantilever design using steel girders. (Forth bridge) Solid construction in stone/brick.

[1]

Family Saloon Car

New Technology: G.P.S., Automatic transmission, traction control, A.B.S., E.B.A. (electronic brake assist), dual fuel, four wheel drive, reversing sensors, electric windows/sun roof, air conditioning/climate control, in-car television, CD player.

[1]

Old technology: Petrol/diesel engine, radio/magnetic tape player, cartridge music player.

[1]

**Maximum of SIX marks**

[0-6]



(c) No mark awarded for the Technology.

0-2 for clearly described advantage. eg

Racing Yacht: Glass fibre hull is lighter and stronger than a wooden hull resulting in an improved performance of the yacht

Mountain Bike: Multi speed gear systems allow better ratio in an increased range enabling the rider to use less energy and achieve better performance.

Road Bridge: Carbon fibre reinforced cables allow for longer spans between towers because of improved strength. This allows for bridging of wider gaps.

Family Saloon Car: CD players provide a better in car entertainment sound and also do not get tangled up like the old fashioned tape drives.

0-2 dependant on information and understanding evidenced.

**[0-2]**

**Total maximum mark for this question is: 12**

2

Structure and form (NB not copied from camera example)

1 mark to be awarded for a good clear sketch or drawing of the chosen product. Two marks for explaining how a specific feature (structure/form) of the product meets its purpose/reflects technology used, eg mobile phone - rounded corners, size, and shell structure reflect the need to be pocket sized and protect inner components.

For example, in the case of a glue gun  
(NB items copied from the given example are not to be accepted.)

Drawing (S)

ABS casing (T) two halves screwed together (S) with self tapping screws (M)

Heating element (M) coiled high resistance nickel chrome alloy wire (T)

Logo which is incorporated into the molding during manufacture (T)

Insulated casing (M) to keep body cool (S)

Aluminium alloy glue nozzle (T), turned on a lathe (S)

Press molded (T) polystyrene (M) trigger (M)

Internal safety electronic cut out switch (M) in case of overload (S)

Two core insulated and sheathed PVC (T) cable (M)

Cord Grip (S)

Textured grip (S) on handle (M) safe to hold (S)

Low temperature melt glue stick (T) minimizes burns risk for H&S (S)

**Total maximum mark for this question is: 12**

- 3** This question refers specifically to modern technology.  
One mark should be awarded for a correct product, technology should relate to product.  
Accept repeats where relevant.
- |     |                        |  |            |
|-----|------------------------|--|------------|
| (a) | Weight reduction:      | car engines, car wheels – aluminium alloy<br>Vehicle bodies – carbon fibre, GRP,<br>Aircraft wings – carbon fibre  | [1]<br>[1] |
| (b) | Stronger:              | Crash helmets, riot shields, telephone box/bus shelter<br>windows polycarbonate  | [1]        |
| (c) | Easier to use:         | Cameras – smart card replacing film,<br>Food/Drinks cans - ring pull lids  | [1]<br>[1] |
| (d) | Safer:                 | Stab proof vests for security services – Kevlar<br>Firemen's jackets (Nomex)<br>Vehicle windscreens (laminated Glass?)   | [1]<br>[1] |
| (e) | Benefits to workforce: | Better working conditions, less dangerous work, (for<br>some people) redundancy payments, Cleaner & safer<br>environment, More interesting products/work, more<br>challenging reference quality and tolerances, feeling<br>more valued by production of a better product, Leads<br>(possibly) to a more highly trained workforce | [2]<br>[2] |

0-2 (twice) for information and understanding evidenced.

**Total maximum mark for this question is: 12**

4

- (a) Can be used in hazardous areas [2]  
 can work 24/7  
 leads to financial savings, [2]  
 increased speed & efficiency  
 constant product quality [2]  
 1 mark for each advantage plus further mark for example or further detail
- (b) Disadvantages to the company  
 High initial installation costs  
 training/retraining existing staff  
 possible loss of income during changeover [2]  
 possible redundancy payments to make  
 some staff becoming disillusioned [2]  
 possible loss of public interest if they preferred hand built methods  
 1 mark for disadvantage (explain) plus second mark for example of further detail  
 Single mark examples: - they are expensive
- (c) Lifting and placing in containers  
 Movement of set number (10 or a dozen) items in one lift for packaging  
 Folding lids and sealing of packaging, [2]  
 Holding product and placing styrene blocks/ends around product prior to boxing  
 Lifting inners to place in outlets  
 Palletising shrink wrapping  
 1 mark for generic eg robots can be programmed  
 Machine readable code  
 Trackable chip  
 1 mark only for tracking delivery vehicles
- (d) Barcodes, identification at source, scanned, inputted data which is accessible [2]  
 remotely  
 1 mark for bar code plus further mark for details given.

**Total maximum mark for this question is: 14**

5

**(a) Answers must be specific.**

Non-Ferrous Metals	Aluminium, Titanium, Tungsten, Copper, Brass, Bronze, Zinc	[1]
Alloys	Brass, Bronze, phosphor bronze, stainless steel, steel	[1]
Polymers	Polystyrene, polyethylene, Polypropylene, Polyvinylchloride (PVC), Polytetrafluoroethylene (PTFE), Acrylonitrile-Butadiene-Styrene (A. B. S.), (Common synthetic fibres include - polypropylene, polyester, Spandex, Rayon, and Lycra)	[1]
Ceramics	silicon nitride, silicon carbide, porcelain, china or other specific clay	[1]
Composites	Concrete, carbon fibre composites, Glass reinforced polyester (G.R.P), plywood, chipboard, MDF	[1]

**(b)**

Engineering Material	Example of where used	Two reasons for its use	
Brass	Pins and contacts on electrical plus and sockets	Good electrical conductivity Easily machined	
Poly vinyl chloride (PVC)	Outer covering on electrical cables and conductors	Excellent insulating properties. Flexible, reasonable weathering properties and working temperature range	[2]
Aluminium alloys	Aircraft bodies and wings Car wheels	Lightweight Non corrosive	+ [4]
Stainless steel	Cutlery	Non corrosive Hard wearing	
A.B.S.	Car bumpers, surfboards, canoes	Tough/impact resistant Lightweight	
Carbon Fibre	Bicycle frames, fishing rods	Touch, strong	

Titanium	Used in a variety of applications, including products where weight is of importance such as aircraft, sporting equipment, etc., Because of its excellent corrosion resistance, titanium is also used for chemical processing, desalination, power generation equipment, valve and pump parts, marine hardware, and prosthetic devices. (eg hip joints etc)	High strength, low weight Corrosion resistant
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**1 Mark (x2) for each example of correct use. Plus 1 mark (x2) for each specific reason given for the use of the engineering material in context stated.**

**Award 1 mark maximum if not related to given context but correct related to engineering material.**

**(c) Recycling:**

Storage of waste, too small a quantity for viable activity, safety issues, environmental issues in storage/transportation of materials, purity of specific materials (contamination of batch).

**Disposal:**

Contamination of air, water tables, unsightly, bulk, transportation of materials, costs related to disposal, lack of biodegradability of many materials, lack of land fill sites, if burnt toxic gasses produced, effect on local environments, possibly noise related to proximity of disposal unit.

The disposal of plastics products contributes significantly to an environmental impact.

Because most plastics are non-degradable, they take a long time to break down, possibly up to hundreds of years when they are land filled (although no-one knows for certain as plastics haven't really existed for long enough). With more and more plastics products, particularly plastics packaging, being disposed of soon after their purchase, the landfill space required by plastics waste is a growing concern.

0-3 dependant on information and examples given. Understanding with depth for full 3 marks must be clearly evidenced.

**[0-3]**

**Total maximum mark for this question is: 14**

- 6 **NB Read the whole response first – credit responses in wrong box but not repeated points.**

**Alternative Process**

**2 marks or 0**

**Must be a different specific process (ie NOT method/equipment eg Pillar drill/ cordless drill = 0 marks)**

**(a) Milling**

Tools & Equipment Milling machine, cutter, drill, clamping device, CNC milling machine, computer **3**

Safety Precaution Guards, examples of PPE, check equipment (cutter), no loose clothing etc. **3**  
CNC: Safety enclosure ok, locked in place, detail eg “stops swarf/offcuts/dust flying out”, check cutter

Alternative Process Drilling, routing, spark erosion, laser cutting **2**

**Drilling**

Tools & Equipment Named specific drill, drill bit, clamping device, centre punch, chuck key **3**

Safety Precaution Examples of PPE, no loose clothing/hair, check equipment, guards in place **3**

Alternative Process Milling, punching, spark erosion, laser cutting **2**

**Soldering**

Tools & Equipment Soldering iron, solder, flux, stand/sponge **3**

Safety Precaution Extraction, PPE, sponge wet, safety area **3**

Alternative Process Adhesion, brazing, welding **2**

**Bending**

Tools & Equipment Folding bars, heater, hammer, mallet, former, jig, line bender, work piece holder **3**

Safety Precaution Guards, gloves. Avoid finger traps/burns **3**

Alternative Process Extrusion, forming **2**

**Brazing**

Tools & Equipment Hearth, gas torch, brazing rod, flux, abrasive paper, clamps device, jig **3**

Safety Precaution PPE, avoid burns, extraction, check equipment, working space **3**

Alternative Process Solder, welding. adhesion **2**

**Surface Finishing**

Tools & Equipment Appropriate to chosen method **3**

Safety Precaution Appropriate to chosen method **3**

Alternative Process In this section only accept alternative finish process eg surface treatment eg anodising, bluing, galvanising, dip coating, knurling, etching **2**

**1 mark for correctly identified:** [2]  
**Tools/equipment/machinery used;**  
**Safety precautions; and**  
**Alternative process for similar effect.**  
**0-2 for details of the above given in the description.**

**B grade question - do not give marks away!**

- (b) Turning: Turning is performed on a machine called a lathe in which the tool is stationary and the part is rotated. Lathes are designed solely for turning operations, so that precise control of the cutting results in tight tolerances. The work piece is mounted on the chuck, which rotates relative to the stationary tool.
- Forming: Includes - forging, extrusion, vacuum forming, hammering, drawing etc.
- Adhesion: This is the property of sticking together (as of glue and wood) or the joining of surfaces of different composition.
- Etching: Wet etching. This is the simplest etching technology. All it requires is a container with a liquid solution that will dissolve the material in question. Unfortunately, there are complications since usually a mask is desired to selectively etch the material. Used extensively in the production of printed circuit boards in the electronics industry.
- Annealing: Annealing is used to treat work-hardened parts made out of low Carbon steels. This allows the parts to be soft enough to undergo further cold working without fracturing. [2]

**No mark for process stated.** [2]

**1 mark for correctly identified equipment/machinery:**  
**Tools/equipment/machinery used;**  
**Safety precautions; and**  
**Alternative process for similar effect.**  
**Further mark for additional information given in description**

**B grade question - do not give marks away!**

**Total maximum mark for this question is: 12**



7

- (a) (i) Any appropriate material which has a coating applied gains reward for 1 mark. [1]
- (ii) 0-2 for good reasoning why coating is used. "Protection" maximum 1 mark without clarification. Likewise aesthetic improvements maximum 1 mark. If statement is " For protection and aesthetic improvement" with no clarification maximum 1 mark. "A" grade question. [2]
- (b) Shape memory alloy: Shape memory alloys (SMAs) can undergo substantial plastic deformation, and then be triggered into returning to its original shape by the application of heat. Used in medical and dental applications and for spectacle frames. The commonest form is Nickel - titanium (Nitinol), but there are many others (eg Goldcadmium; Nickel-titanium-copper; Copper-aluminium-iron; Ironmanganese-silicon; Iron-zinc-copper-aluminium and many more.
- Carbon Fibre: Carbon fibres are the stiffest and strongest reinforcing fibres used in conjunction with polymer composites and are the most used after glass fibres.  
Made from pure carbon in form of graphite, they have low density and a negative coefficient of longitudinal thermal expansion. They are frequently used together with epoxy, where high strength and stiffness are required, Le. race cars, automotive and space applications, sport equipment.
- Epoxy Resin: Two part adhesive. Exceptional strong bonding qualities and flexible In that dissimilar materials can be bonded together.
- Motion control Gel: 'Smart grease' is one of a wide range of new motion control gels. These are 'lubricants' which are specially formulated to give characteristics other than just lubrication. 'Smart grease' is a particularly sticky and viscous gel with fantastic shear characteristics. If a tiny amount of 'smart grease' is added between friction surfaces of say a motor shaft and bearing, then the shaft will turn at a constant steady (very slow) speed and the stored energy will be released uniformly. Used for example in CD drawers on Hi-Fi units.

*Continued on next page*

<u>Thermochromic ink:</u>	Thermochromic inks or dyes are temperature sensitive compounds, (developed in the 1970s), that temporarily change colour with exposure to heat. They come in two forms, liquid crystals and leuco dyes. Liquid crystals are used in mood rings, necklaces, toe tings and bracelets (body temperature sensitive). Leuco dyes are easier to work with and allow for a greater range of applications. These applications include: flat thermometers, battery testers, clothing, and the indicator on jars of eg, baby food that change colour when the food is warm. Used in the clothing industry in the manufacture of 'T' shirts and shorts The thermometers are often used on the exterior of aquariums, or to obtain a body temperature via the forehead.	[3]
Polycarbonate polymer:	Exceptionally strong thermoplastic. Normally clear used for crash helmets, riot shields, safety machine guards. Works as Acrylic. Also bullet proof.	[3]

**0-3 (x2) for details and information provided. Grade A question.**

**(c) Award 1 mark for each relevant point to 3.**

Items containing an **LCD (liquid crystal display)** in laptop computers, digital clocks and watches, microwave ovens, CD players and many other electronic devices. LCDs are common because they offer some real advantages over other display technologies. They are thinner and lighter and draw much less power than cathode ray tubes (CRTs), for example.

**Total maximum mark for this question is: 12**

8 Look for:

- Identify three relevant issues/points raised by the question I
- Explain why you consider two of these issues/points to be relevant; and R
- Use one specific example or piece of evidence to support your answer. E

**Focus on both aspects**

If a candidate has clear and detailed understanding but does not adhere to the structure award positively do not give marks away for "guesses".

**(a) CIE:**

**1 mark for simple statement/part answer eg 'CAD/CAM makes products better engineered product' or 'reduces product development time'**

**+1 for benefit explanation 'less paper transfer of information as production progresses'**

**+1 for benefit which refers to shared data (ie showing understanding of integration) eg CAD/CAM linked together so don't make mistakes.**

**N.B. Award third mark only if understanding of linked/sharing shown**

- reduce product development time because concurrent engineering is possible
- reduce product development time because CAD designs are sent directly to CAM
- centrally held data means less paper transfer of information as production progresses
- use materials/people/machinery more efficiently because production planning is automated
- order tracking possible throughout process (eg through bar-coding of product batches)
- fewer people chasing progress/meeting to exchange information between departments
- machine downtime for routine maintenance is more easily scheduled into system, reducing idle time
- all components ordered to match production plan JIT production facilitated, reduces stock costs
- production plan can be amended to meet changes in ordering (eg sudden large order)
- production can be readily switched between products if problems occur at any stage
- One production line can make a range of product specs (eg Nissan cars made to order)

**[6]**

**(b) Local environments:**

- Improved transport links and traffic controls
- internet purchases means less travel effect on local roads
- less emissions
- less noise or more noise – needs explanation
- better/more improved domestic products
- improved social facilities
- more people working from home
- improved domestic and commercial communications
- better local lighting.
- reduce crime (CCTV), speed cameras, traffic lights
- landfill sites

Identification and expansion an any of the above. List is not exhaustive.

**[6]**

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**Total 100 marks**

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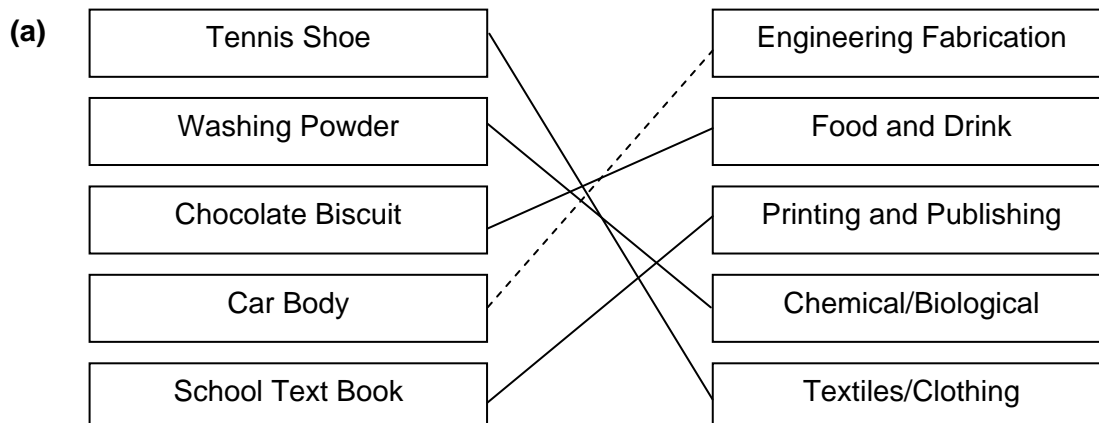
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1



1 mark per correct link. Do not reward the point which has been given (dotty line). [4]

(b) **Products must be listed in part (a)**  
**Accept generic response eg 'robotics'**  
**once only**

Tennis Shoe: Ultra sound bonding of fabrics [1]

Traditional sewing [1]

Washing Powder: Many biological washing powders contain enzymes to help with the removal of stains. [1]  
 The enzyme may be a protease to break down protein stains or a lipase to break down fats and oils (lipids) [1]

Soap [1]

Chocolate Biscuit: Automatic ovens for even baking

Traditional ovens

School Text Book: Colour printing/DTP, laser printer

Black on white printing, typewriter

(c) No mark for Modern Technology.

For selected Modern Technology advantage clearly stated eg

Tennis Shoe: No unsightly stitching visible or stronger as needle does not puncture fabrics [2]

0-2 dependant on amount of detail and understanding given.

**Total maximum mark for this question is: 12**

2

Structure and Form (NB not copied from camera example)

1 mark to be awarded for a good clear sketch/drawing of the chosen product. Two marks for explaining how a specific feature (structure/form) of the product meets its purpose/reflects technology used, eg mobile phone – rounded corners, size and shell structure reflect need to be pocket sized and protect inner components.

For example, in the case of a glue gun: (NB Items copied from the given example are not to be accepted).

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Logo which is incorporated into the molding during manufacture (T)

Insulated casing (M) to keep body cool (S)

Aluminium alloy glue nozzle (T), turned on a lathe (S)

Press model (T) polystyrene (M) trigger (M)

Internal safety electronic cut out switch (M) in case of overload (S)

Two core insulated and sheathed PVC (T) cable (M)

Cord Grip (S)

Textured grip (S) on handle (M) safe to hold (S)

Low temperature melt glue stick (T) minimizes burns risk for Health & Safety (S).

**Total maximum mark for this question is: 12**



3

This question refers specifically to modern technology.  
One mark should be awarded for a correct product, technology :should relate to product. Accept repeats where relevant.

- |            |                        |  |                          |
|------------|------------------------|--|--------------------------|
| <b>(a)</b> | Weight reduction:      | car engines, car wheels – aluminium alloy<br>vehicle bodies – carbon fibre, GRP,<br>aircraft wings – carbon fibre.   | <b>[1]</b><br><b>[1]</b> |
| <b>(b)</b> | Stronger:              | crash helmets, riot shields, telephone box/<br>bus shelter windows polycarbonate.  | <b>[1]</b><br><b>[1]</b> |
| <b>(c)</b> | Easier to use:         | cameras – smart card replacing film,<br>food/drinks cans – ring pull lids.   | <b>[1]</b><br><b>[1]</b> |
| <b>(d)</b> | Safer:                 | stab proof vests for security services – Kevlar<br>firemen’s jackets (Nomex)<br>vehicle windscreen (laminated glass?).   | <b>[1]</b><br><b>[1]</b> |
| <b>(e)</b> | Benefits to workforce: | better working conditions, less dangerous work,<br>(for some people) redundancy payments,<br>cleaner and safer environment, more interesting<br>products/work, more challenging reference<br>quality and tolerances, feeling more valued by<br>production of a better product, leads (possibly)<br>to a more highly trained workforce. | <b>[2]</b><br><b>[2]</b> |

0-2 (twice) for information and understanding evidenced.

**Total maximum mark for this question is: 12**

4

- (a) Can be used in hazardous areas. [2]  
 Can work 24/7.  
 Leads to financial savings. [2]  
 Increased speed and efficiency. [2]  
 Constant product quality. [2]

1 mark for each advantage plus further mark for example or further detail.

- (b) Disadvantages to the company  
 High initial installation costs.  
 Training/retraining existing staff. [2]  
 Possible loss of income during changeover.  
 Possible redundancy payments to make. [2]  
 Some staff becoming disillusioned.  
 Possible loss of public interest if they preferred hand built methods.

1 mark for disadvantage (explain) plus second mark for example or further detail.

Single mark examples: – they are expensive

- (c) Lifting and placing in containers.  
 Movement of set number (10 or dozen) items in one lift for packaging.  
 Folding lids and sealing of packaging. [2]  
 Holding product and placing styrene blocks/ends around product prior to boxing.  
 Lifting inners to place in outers.  
 Palletising, shrink wrapping.  
 1 mark for generic eg robots can be programmed

- (d) Barcodes. Identification at source, scanned, inputted data which is accessible remotely. [2]

1 mark for bar codes plus further mark for details given.

Machine readable code

Trackable chip

1 mark only for tracking delivery vehicles

**Total maximum mark for this question is: 14**

5

1 mark for showing awareness of the stage of production or appropriate ICT feature/application

In each case for 2 marks must give a “ how, what or why”

(a) Designing:

- researching
- production of specification/questionnaire
- production of ideas
- sending ideas to a client
- emailing for information
- CAD
- WWW (research)
- Simulation
- Virtual modelling
- testing.

[2]

Production Planning:

- Production of charts (flow/Gantt)
- Communications with staff/other departments/companies
- Calculations of timings
- Calculations of materials
- Cim
- Quality control calculations.

[2]

Material Supply and Control:

- Obtaining stock
- Maintaining stock
- JIT
- Quality checks on materials/weights/amounts
- Automatic re-ordering
- Researching materials and availability
- Calculations of amounts needed
- Calculations of costing of materials and alternatives.

[2]

Processing – Production:

- CAM
- CIM
- Bar coding/tracking
- Quality control
- Quality assurance
- Monitoring
- Sensors to check/detect/warn
- Control of robotics
- Control of production (PLC's)
- Screens to view.

[2]

Packaging: **NOT DESPATCH**

- weighing/measuring of amounts
- quality control of amounts (inners/outers etc)
- bar coding/tracking
- production of labels/instruction information
- monitoring.

[2]

0-2 for each description

- (b)
- Calculations on amounts/types of materials to be used.
  - Simulation (modelling) prior to manufacture.
  - CIM integration save time = money.
  - Robotics in some situations needs less manpower = less wages. [1]
  - Robotics can be reprogrammed quickly so less down time/  
re-tooling etc. [1]
  - Emails are cheaper than phone calls.

1 mark for each correctly identified way money could be saved.

- (c)
- Sensors on lighting.
  - Sensors on heating.
  - Automatic ovens.
  - Control of ventilation systems.
  - Automatic door closing.

1 mark for method of saving money **must be related to energy** and one [2]  
for explanation.

Award 2 marks if two clearly different reductions are identified.

**Total maximum mark for this question is: 14**

6

- (a) Allocating appropriate roles and responsibilities:
- Ensuring all personnel have specific tasks within their capabilities/work to strengths
  - Changing/varying roles to avoid disenchantment
  - Ensuring responsibilities to get the job done
  - Avoiding personnel being under used/valued
  - If personnel don't have allocated roles duplication could happen
  - If personnel don't have allocated roles "gaps" could materialise
  - If role/responsibility too great unhappiness could ensue
  - Appropriate feeling of self worth
  - Appropriate feeling as valued member of team
  - Smoother production because personnel within their comfort zone.

1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation.

[2]

Setting and agreeing individual and team targets:

- Short term targets help identify delays early
- Avoidance of lack of structure to task in hand.
- Providing "clear" structure to enable quality control to be easily undertaken
- Providing tangible focus for activity
- Providing opportunity for individual to see where they fit into bigger picture
- Bonding of team
- Sharing responsibility for "the bigger picture"
- Ability to "switch" personnel because weaknesses can more easily be identified.

1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation.

[2]

Good communication:

- Ensuring manufacturing proceeds unhindered
- Quickly informing rest of team of problems which affect production
- Enabling all team members to function at their best as part of team
- Enables worker to be moved/task changed to speed production/ensure consistency
- To enlist support for worker "under pressure"
- Maintain morale
- Health and Safety issues avoided/maintained more easily.

1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation.

[2]

Motivation:

- If all team members motivated work more efficient
- Avoids negativity which would affect other team members
- Avoids negativity which affects production
- Enables above 3 points to be more easily achieved
- Buoyancy of situation makes for happier working environment which reflects on quality of work/deadlines etc
- If all staff motivated more easy to prop up a “downed” colleague
- Promotes team values more readily.

1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation. [2]

Creating an appropriate working environment:

- Health and Safety issues
- Allows for quicker/more efficient product
- Allows for above points to be more easily maintained; Comfort of worker
- Avoids stress and unhappiness
- Saves costs related to cleaning up and clothing etc
- Impresses clients/other companies
- Saves time = money
- Less waste time materials etc
- Happy workforce.

| 1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation. | [2] |

(b) Changes in:

- Staffing efficiency
- Illness
- Machine downtime
- Material shortages
- Client changing requirements
- Materials not available
- Miscalculations in original plan
- New team members
- Team members requiring a change of activity
- Health and Safety issues
- External factors ie fuel costs/material costs/environmental dictates/seasonal variations.

1 mark for identified point plus 2<sup>nd</sup> mark for additional details/explanation. [2]

**Total maximum mark for this question is: 12**

7

- (a) (i) Any appropriate material which has a coating applied gains reward for 1 mark. [1]

Note (i) and (ii) need not be related.

- (ii) 0-2 for good reasoning why coating is used. "Protection" maximum 1 mark without clarification. Likewise aesthetic improvements maximum 1 mark. Simple statement with no clarification (eg how or why) maximum 1 mark. "A" grade question. [2]

Award marks for awareness of the materials given. Broadly 1 mark for a property + 1 for an appropriate use + 1 for further detail or specific detail as given below.

- (b) Gortex:

A waterproof, breathable fabric used in sports and outdoor clothing. Made from a fabric which contains microscopic 'pores' in its construction. These pores are too small to allow ingress of rain, but are large enough to allow egress of perspiration.

NOT insulating

Nomex:

A fibre with a combination of high-performance heat and flame-resistant properties, as well as superior textile characteristics. Used in the manufacture of firemen's jackets and other flame retardant protective clothing.

SOFT switch Fabric:

**SOFT switch** fabrics are 'touch sensitive' - when mechanically distorted or compressed they exhibit a large change in electrical resistance that is proportional to the applied force. This response allows **SOFT switch** fabrics to be used both as switches and pressure sensors, responding to the lightest touch or the hardest hammer blow. In use, they retain the benefits of textiles, ie, washability, handling, durability, ability to be molded into 3D forms, and fashion styling.

They also provide the function of electronic control, eg, enabling a snowboarder to control an iPod from her sleeve or a doctor to identify when and where a bed-ridden patient is in danger of developing a pressure sore.

Probiotic Yoghurt:

The term 'Probiotic' refers to so called 'friendly' bacteria which colonise the digestive tract. 'Friendly' because they work in many useful ways. They can reduce the build up of wind, boost the immune system, prevent harmful bacteria from taking hold (helping to prevent infections) and help us to absorb nutrients from our diet. A proper balance between the beneficial bacteria and harmful bacteria must be kept to maintain a healthy, regular digestive system.

NOT other dietary benefits of yogurt in general.

Tofu:

Tofu is an easy to digest, somewhat bland food with a texture similar to cheese. It is made from soybean curd and is often substituted for meats, cheeses and certain dairy products because of its healthful properties. Tofu is also a popular food choice among people who don't eat animal products. It is used in many different diets, including vegan and vegetarian eating plans. Tofu is also a staple in many low fat, low cholesterol diets, and is regarded as a healthy part of high protein low-carbohydrate lifestyles.

TVP:

Textured vegetable protein (TVP), also known as textured soy protein (TSP), is a meat substitute made from defatted soy flour, a by-product of making soybean oil. It is quick to cook, high in protein, and low in fat.

Textured vegetable protein comes as small dry chunks or flakes when bought in bulk. It has little flavour of its own and needs to be rehydrated and flavoured (both can be accomplished in the same step), then added to cooking.

[3]

TVP is a versatile substance, different forms allowing it to take on various textures, one can make vegetarian or vegan versions of popular dishes such as - chili, tacos, burgers, sausages etc.

[3]

**0-3 (x2) for details and information provided. Grade A question.**

**(c) Award 1 mark for each relevant point to 3.**

Items containing an **LCD (liquid crystal display)** in laptop computers, digital clocks and watches, microwave ovens, CD players and many other electronic devices. LCDs are common because they offer some real advantages over other display technologies. They are thinner and lighter and draw much less power than cathode ray tubes (CRTs), for example.

**Total maximum mark for this question is: 12**



8

Look for:

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

**Focus on both aspects**

If a candidate has clear and detailed understanding but does not adhere to the structure award positively do not give marks away for "guesses".

I  
R  
E

(a)

CIM:

**1 mark for simple statement/part answer eg 'CAD/CAM makes products better engineered product' or 'reduces product development time'.**

**+1 for benefit explanation 'less paper transfer of information as production progresses'.**

**+1 for benefit which refers to shared data (ie showing understanding of integration) eg CAD/CAM linked together so don't make mistakes.**

**NB Award third mark only if understanding of linked/sharing shown**

- Reduce product development time because concurrent Manufacturing is possible.
- Reduce product development time because CAD designs are sent directly to CAM.
- centrally held data means less paper transfer of information as production progresses.
- Use materials/people/machinery more efficiently because production planning is automated.
- Order tracking possible throughout process (eg through bar-coding of product batches).
- Fewer people chasing progress/meeting to exchange information between departments.
- Machine downtime for routine maintenance is more easily scheduled into system, reducing idle time.
- All components ordered to match production plan JIT production facilitated, reduces stock costs.
- Production plan can be amended to meet changes in ordering (eg sudden large order).
- Production can be readily switched between products if problems occur at any stage.
- One production line can make a range of product specs (eg Nissan cars made to order).

**(b) Local environments:**

- Improved transport links and traffic control
- internet purchases means less travel effect on local roads
- less emissions
- less noise or more noise – needs explanation
- better/more improved domestic products
- improved social facilities
- more people working from home
- improved domestic and commercial communications
- better local lighting.
- reduce crime (CCTV), speed cameras, traffic lights
- landfill sites

**[6]**

Identification and expansion on any of the above. List is not exhaustive.

**Total maximum mark for this question is: 12**

**TOTAL 100 MARKS**

**General Certificate of Secondary Education  
Manufacturing (Specification Code 1496)  
June 2007 Assessment Series**

**Unit Threshold Marks**

<i>Unit</i>		<b>Maximum Mark</b>	<b>a*</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>u</b>
<b>4878</b>	Raw	50	45	40	35	30	24	19	14	9	0
	UMS	100	90	80	70	60	50	40	30	20	0
<b>4879</b>	Raw	50	45	40	35	30	24	19	14	9	0
	UMS	100	90	80	70	60	50	40	30	20	0
<b>4880</b>	Raw	100	77	66	55	45	39	33	28	23	0
	UMS	100	90	80	70	60	50	40	30	20	0

**Specification Aggregation Results**

**Entry Information**

<b>Unit</b>	<b>Total Entry</b>
<b>4878</b>	1275
<b>4879</b>	1282
<b>4880</b>	1308

**Specification Aggregation Results**

<b>GRADE</b>	<b>A*A*</b>	<b>AA</b>	<b>BB</b>	<b>CC</b>	<b>DD</b>	<b>EE</b>	<b>FF</b>	<b>GG</b>	<b>UU</b>
<b>UMS</b>	270	240	210	180	150	120	90	60	0
<b>Cum %</b>	1.0	6.3	18.6	37.4	56.8	74.4	87.4	94.4	100

1296 candidates aggregated this session

For a description of how UMS marks are calculated see;  
[http://www.ocr.org.uk/exam\\_system/understand\\_ums.html](http://www.ocr.org.uk/exam_system/understand_ums.html)

Statistics are correct at the time of publication



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