Mark Scheme (Results)

Summer 2014

Pearson Edexcel
GCE in Design & Technology
Product Design
Resistant Materials
6RM03 01
(Paper 01: Designing for the Future)

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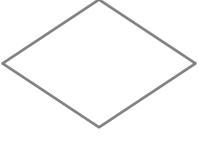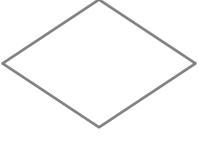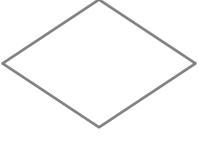
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.

- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.

- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.

- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark
1(a)	Any **four** of the following examples from: • Data is transferred at a higher/quicker/faster rate **(1)** • Safer / more secure / reduced security risk from viruses / hackers / spy ware **(1)** • LANs tend to be bespoke/adaptable in their design/specification **(1)** • Easy centralised /compatible software management / maintenance / repair **(1)** • Resource (peripheral devices) sharing **(1)** • Better / easier / communication / chat / access to / sharing of files, work or info /storage within the LAN **(1)** • Easier tracking of info/transactions/usage **(1)** • Company can limit users to specific/relevant applications **(1)** • LANs don't require subscriptions/payments **(1)** (4 x 1)	**(4)**
1(b)	• Sensor (e.g. probe/laser/CMM/intelligent camera) **(1)** • Makes contact / touches /scans/visually inspects the work **(1)** • Results compared to / meets the specification / tolerances / standards/ shape and size **(1)** • Work/make decisions at high speed / accurately /precisely / constantly / 24-7 /every product / reduced human error **(1)** • Feedback leads to identification of problem / stopping of / automatic adjustment / correction of machinery / ejection of faulty components **(1)** • Reduces errors/waste **(1)** (4 x 1)	**(4)**
	Total for question	**8**

Question Number	Answer	Mark
2(a)	- A machine that exhibits / mimics human intelligence/behaviour/ characteristics **(1)** - A machine that has the ability to learn/adapt/think/problem solve / make decisions through experience **(1)** - A machine that can simultaneously process a large amount of information **(1)** **(2 x 1)**	**(2)**
2(b)	Decision used to indicate where a choice / yes-no (question) is to be made / check / feedback **(1)** Terminator/start/stop used at the ends of the flow chart **(1)** Process used to initiate an action / function / task / event**(1)**	**(3)**
	Total for question	**(5)**

Question	Answer	Mark
3(a)(i)	• Carbohydrates / starch /sugar/glucose / bacteria / micro-organisms / enzymes / yeast are added **(1)** • Fermentation **(1)** • Material (reserve) collects in cells **(1)** • Material (reserve) extracted/separated **(1)** • Material (reserve) is refined into white powder / monomer **(1)** • Monomer is turned into a polymer (polymerised) **(1)** **(3 x 1)**	**(3)**
3(a)(ii)	Any **three** of the following examples from: • Biodegradable **(1)** • Sustainable / renewable polymer as it can be re-grown **(1)** • Degrades quickly **(1)** • Degrades fully/takes up less space in landfill **(1)** • Doesn't require finite resources for production **(1)** • Doesn't produce many toxic by-products during production/ biodegrading, that affect the environment / carbon-neutral **(1)** • It can be recycled **(1)** • Doesn't require much energy to produce **(1)** **(3 x 1)**	**(3)**
3(b)	• Soil erosion **(1)** • Watershed destabilisation **(1)** • Climate / micro climate change/global warming **(1)** • Reduction of genetic / bio diversity / eco-systems / increased chance of extinction/endangered status (both plants and animals) / destruction of wildlife / natural habitats / food sources **(1)** • Indigenous people / people reliant on the forest have their lives / livelihoods / homes / villages destroyed / changed **(1)** • Undocumented knowledge of forest management is lost **(1)** • Timber shortage / price increase **(1)** • Reduced oxygen/increase carbon dioxide **(1)** • Reducing the availability of medical products **(1)** • Destruction of beauty spots/scenery / scars landscape **(1)** • Detrimental effect caused by machinery / infrastructure e.g. pollution (air/noise) / fuel consumption **(1)** • Soil quality deteriorates **(1)** • Slow regeneration **(1)** **(6 x 1)**	**(6)**
	Total for question	**12**

Question Number	Answer	Mark
4(a)	- Reduced time to market / lead time **(1)** - Fewer bottlenecks **(1)** - Reduced design errors/improved designs/improved quality / improved quality control **(1)** - Optimum capacity with minimum stock levels **(1)** - Increased flexibility **(1)** - Improved productivity / reduced downtime /more efficient / faster production rate **(1)** - Higher profit **(1)** - Easier / faster / more accurate way to manage / plan / track the creation / change / archiving of product / production/info / real-time editing **(1)** - Central / reduced / safe / secure storage of info means easy / fast access for all employees / enhanced collaboration **(1)** - Stored data gives easy /automated report (progress/financial/cost/stock) generation **(1)** **(4 x 1)**	**(4)**
4(b)	Advantages - Integrates all departments across a company **(1)** - Same software used across all departments **(1)** - Easy / fast communication speeds up development **(1)** - Automation /increased speed / easy tracking of customer order/processing/invoicing **(1)** - Instant information available e.g. credit ratings/order **(1)** history/stock levels/delivery schedule **(1)** - Orders / materials automatically replaced when needed / move to next department when complete/reduced storage/transport needed **(1)** - Visibility across all departments **(1)** - Unified (database/central storage/backup) **(1)** - Increases worker moral / customer satisfaction **(1)** - Streamlining of processes / lean manufacturing / quicker to market / reduced lead time **(1)** Disadvantages - Cost of infrastructure/ICT upgrades **(1)** - Cost of / need for workforce training / recruitment **(1)** - Resistance to change from a workforce **(1)** - Success depends on all departments being strong / no weak links **(1)** - Takes time / effort to implement **(1)** - Systems may need to be customised **(1)** - Migration of existing data to a new system is difficult **(1)** - Company could get 'locked' into further upgrades/customisations. **(1)** - Potential software failure/ reliability or user/human error **(1)** - System compatibility issues may need considering before implementation **(1)** **(6 x 1)**	**(6)**
	Total for question	**10**

Question Number	Answer	Mark
5(a)	References to any of the following: (more than **one** reference can be made to any of the categories). • Balance **(1)** • Proportion **(1)** • Material **(1)** • Shape/ size **(1)** • Effectiveness **(1)** • Hygiene **(1)** • Ergonomics **(1)** • Anthropometrics **(1)** • Aesthetics / appeal **(1)** • Form over function / 'less is bore' / a sense of fun / humour **(1)** **Do NOT award a mark for just listing the words in the first NINE of the above bullet points – they should be used in reference to a part of the juicer as shown in the examples below. However a sentence which states Starck has used form over function, or 'less is bore' should be credited with a mark.** Sample answer (ONE) based on one bullet point – i.e. shape The shape of the juicer is rounded at the top in order to make it fit the shape of the fruit (1). The ribbed shape enables the maximum juice to be removed from the fruit (1). The pointed base to the squeezer allows the juice to be channelled into a glass more easily (1). The part of the legs which join to the body slope uphill to stop the juice flowing down the legs(1). The shape of the legs allows easy access for a glass(1). The overall shape of the juicer is 'organic' / unique / individual (sci-fi/ rocket/ spider legs etc) / natural / 'streamlined' / 'tear-drop' shaped, which is typical of this Starck design (1). Sample answer (TWO) based on multiple bullet points The legs form a wide base to increase stability (1) The surface of the juicer is smooth to make it easy to clean/hygienic (1) The design of the juicer is aesthetically interesting (1) The anthropometrics allow the juicer to fit the hand of the user (1) The shape of the body of the juicer directs the juice into the glass (1) The material used is strong enough to withstand the pressure applied when squeezing the fruit (1) The functionality could be considered as flawed (1) e.g.: • there is no facility to separate pips/pith • difficult to hold whilst using • difficult to store • scratches surfaces **(6 x 1)**	**(Max 6)**

5(b)	• Identify the target population (age/gender/region/etc) **(1)** • The designer must consider designing for the greatest number / majority of users possible **(1)** • Consideration of relevant body dimension / difference is size of people (height/width/reach/etc) **(1)** • Use normal distribution curves to assess the spread of the target population **(1)** • Product designed to fit 90% of the population/exclude those who fall outside the 5th-95th percentile range **(1)** • Some products will be designed for the average person **(1)** • Some products will have adjustment incorporated **(1)** • Some products will be designed in a range of sizes **(1)** • Range of motion / flexibility of the user (1) **(6 x 1)**	**(6)**
	Total for question	**12**

Question Number	Answer	Mark
6(a)	• It is the presented data (e.g. process tree/graph/table) **(1)** • It is an evaluative environmental / sustainability management tool **(1)** • Lists inputs and outputs during industrial processes **(1)** • Shows / costs raw materials which have been/could have been used / how their use could be reduced / that are wasted **(1)** • Shows / costs energy which has been/could have been used / how its use could be reduced / that is wasted **(1)** • Indicates what emissions/waste can/will occur **(1)** • For the entire life/cradle to grave of the product **(1)** • Works out/calculates/shows a product's carbon footprint/ environmental effect **(1)** • It can factor-in economical inputs and outputs of a product **(1)** **(4 x 1)**	**(4)**
6(b)	Advantages • The earth's natural finite resources are preserved **(1)** • Recycling materials is cheaper than the expensive / difficult extraction of natural resources **(1)** • It saves energy **(1)** • It reduces CO_2 emissions / pollution **(1)** • Less waste needs to be disposed of in landfill **(1)** • Reduces the need / cost to incinerate waste **(1)** • Reduced landscape scarring/wildlife habitat destruction / deforestation **(1)** • Generates employment **(1)** • Metals generally retain their qualities when recycled **(1)** • Enhanced company reputation / sales for using eco-friendly materials / people willing to pay more (doing their bit for the environment) **(1)** Disadvantages • Pollutants are produced / energy used by the recycling process **(1)** • Most recycled materials end up as lower grade/quality materials / can only be recycled a finite number of times **(1)** • New facilities are needed for the recycling operation **(1)** • Some materials are expensive / not cost effective / not possible / difficult to recycle / sort **(1)** • Products made from recycled materials are often more expensive (1) • Some recycling jobs are low-quality/undesirable / labour intensive / expensive **(1)** • Special collection / transport / product recovery services need to be provided/paid for / made easy or people may not bother **(1)** **(9 x 1)**	**(9)**
	Total for question	**13**

Question Number	Answer	Mark
7	Any 10 of the following points, max 9 marks if all answers only come from advantages or disadvantages. Advantages • Uranium is abundant / reduces the need for fossil fuels to be used **(1)** • Lessens the greenhouse effect/low emissions / low pollution **(1)** • Produces a small amount of waste **(1)** • Modern reactors are safer **(1)** • Comparably not expensive to generate **(1)** • Produces a huge amount of energy / efficient **(1)** • Reliable/consistent/fast response to demand / supply of energy **(1)** • The residual heat generated can be used as a by product for heating **(1)** • Power stations are relatively small / need little infrastructure / can be set up in remote areas **(1)** Disadvantages • People are sceptical about safety / mistrust / not in my back yard **(1)** • Storing / disposal of radioactive waste is a problem **(1)** • Potential dangers of background radioactive contamination / radiation / catastrophic failure **(1)** • Mining of uranium causes environmental scarring **(1)** • Uranium is finite and will eventually run out **(1)** • Nuclear is a long-term solution as a site takes years to develop/build **(1)** • Attacks could have devastating effect **(1)** • Potential to create nuclear weapons **(1)** • The plants have a relatively short lifespan **(1)** • Need to be near water supply **(1)** **(10 x 1)**	**(10)**
	Total for question	**10**