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Mark Scheme (Results)

Summer 2013

GCE Design & Technology Product Design
Resistant Materials (6RM02)

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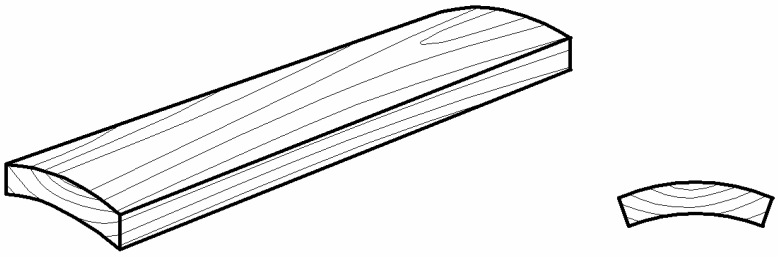
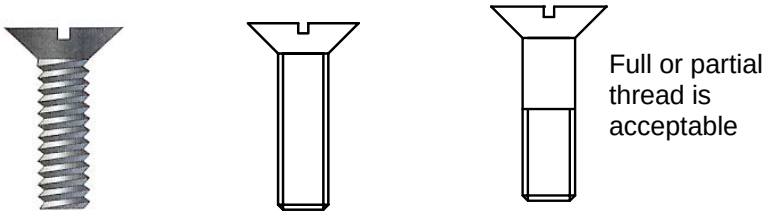
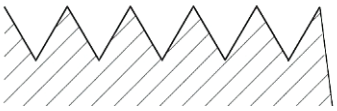
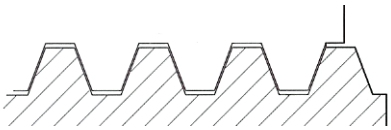
Question Number	Answer	Mark
1(a)	Any of the following: • Deciduous trees / trees which lose their leaves in winter **(1)** • Cell structure **(1)** • Leaves/not needles **(1)** • Trees with enclosed seeds **(1)** • Fruit / nut bearing trees **(1)** ***[Do not except hard or strong but accept correct opposite points Eg. trees that do not have needles.]*** **(1 x 1)**	**(1)**
1(b)	Any **three** of the following with a linked relevant explanation: • Tough **(1)** so will withstand impacts and rough handling. **(1)** • Strong **(1)** so that it can withstand large forces / being stood on. **(1)** • Hard **(1)** so that it will withstand wear, dents and scratches. **(1)** • Splinter resistant **(1)** smooth wearing/so that it is less likely to cause an injury. **(1)** • Takes a finish well **(1)** due to close grain structure.**(1)** • Has few knots **(1)** so reduced risk of inherent weaknesses causing split during use / resin seeping through finish. **(1)** • Easy to shape / work / machine / glue **(1)** reducing production speed/costs. **(1)** • Aesthetics grain pattern **(1)** making the toy more appealing. **(1)** • Durable **(1)** so resisting wear and tear over long periods. **(1)** **[Do not accept cheap, readily available, light weight, sustainable or recyclable]** **(3 x 2)**	**(6)**
1(c)	**Both** the following points from either form of diagram:  • Plank bent along its width. **(1)** • Shows end grain straightening **(1)** **(1 x 2)**	**(2)**
	Total for question	**9**

Question Number	Answer	Mark
2(a)	Any **three** of the following: • Apron / overall **(1)** • Safety shoes **(1)** • Gloves **(1)** • Hair band / net / hat **(1)** • Armlets **(1)** • Full face shield **(1)** **[Do not accept dust mask or ear defenders]** **(1 x 3)**	**(3)**
2(b)	Any **one** of the following points: • To prevent the tip of the drill from slipping / guides the drill **(1)** • To provide an accurate start point for the drill. **(1)** **(1 x 1)**	**(1)**
2(c)	Any **three** of the following: • To reduce friction / heat in the drill / work keeping it cool. **(1)** • To increase the material removal rate / drill quicker. **(1)** • To wash away cuttings. **(1)** • To lubricate the cutting action / allow smooth drilling process / reduces snatching. **(1)** • To provide a better surface finish. **(1)** • To extend the life of the tool / reduce wear. **(1)** • To prevent welding of chip to tool **(1)** **(1 x 3)**	**(3)**
	Total for question	**7**

Question Number	Answer	Mark
3(ai)	Any version of the following answer: • To hand / finger tighten the nut / tighten without tools. **(1)** **(1 x 1)**	**(1)**
3(aii)	Any version of the following answer: • To act as a locking device / prevent a component working loose under vibration. **(1)** • To maintain pressure / tension / take up slack where a components needs to remain adjustable / loose. **(1)** **(1 x 1)**	**(1)**
3(b)	A recognizable diagram that has the following features shown in the diagrams:  • A countersunk head. **(1)** • A parallel threaded shank with a flat end / not pointed. **(1)** **(1 x 2)**	**(2)**

3(c)	A recognizable diagram of **two** of the following with their relevant working characteristic: V-thread  **(1)** • Generates a lot of friction/locks in place. **(1)** • Can be used with readily available standard components e.g. nuts. **(1)** **[Note – Do not accept responses directed at wood screws or strength, as V-threads strip easiest.]** Buttress thread  **(1)** • Applies force in one direction only. **(1)** • Facilitates quick release systems / easy engagement. **(1)** **[Note – Do not accept strength, as unless the threads are made larger the buttress has a similar low level of strength like the V-thread.]** Acme thread  **(1)** • Strength / transmits large forces. **(1)** • Applies force in both directions.**(1)** • Allows a disengaging facility / easy engagement. **(1)** **(2 x 2)**	**(4)**
	Total for question	**8**

Question Number	Answer	Mark
4(a)	Any **three** of the following with a linked relevant explanation: • Good electrical insulator **(1)** so electricity will not pass through / the user is not at risk of electrocution/ safe to use. **(1)** • Appropriate strength / toughness / hardness / durability **(1)** so does not break /wear under normal use. **(1)** • Heat resistant / thermosetting polymer **(1)** so will not melt if the plug gets hot. **(1)** • Easily moulded/formed **(1)** making it suitable for fast / mass production. **(1)** • Water resistant **(1)** so moisture is shielded from electricity **(1)** **[Do not accept generic properties which show no specific knowledge of UF, ie. Easily cleaned, corrosion resistant, self finishing, range of colours].** **[Do not accept answers based on cheapness.]** **(2 x 3)**	**(6)**
4(b)	Any form of the following **two** points. • Apply ultra violet light / direct sunlight (Not light) **(1)** resulting in a colour change. **(1)** **(2 x 1)**	**(2)**

4(c) QWC	Any of the following points :- • Low power consumption /energy efficient. **(1)** • Be powered by smaller batteries / longer battery life. **(1)** • Cheaper to run. **(1)** • Can be solar powered. **(1)** • More sustainable / eco-friendly. **(1)** • Panels are very thin. **(1)** • Can fit into small spaces / be easily incorporated into products. **(1)** • Panels can be applied to curved/ flexible products. **(1)** • They are waterproof. **(1)** • They are tough /robust /reliable. **(1)** • Need little maintenance / are long lasting. **(1)** • They do not get hot. **(1)** • They are safer to use than some lighting forms. **(1)** • Cheap to manufacture. **(1)** • Even illumination over the whole panel **(1)** • Large areas / panels can be lit from a single source. **(1)** • Emits light uniformly /wide viewing angle /can be seen from all directions. • Comfortable to the eye / no glare. **(1)** • Light is instant / no warm up time. **(1)** • Not very bright. **(1)** • Can be made/ cut to any shape. **(1)** • Lightweight units. **(1)** • Colour variations are possible. **(1)** • Phosphor layer degrades relatively quickly in early units **(1)** giving products a limited life**.(1)** **(6 x 1)**	**(6)**
	Total for question	**14**

Question Number	Answer	Mark
5(a)	The following answer: • Tensol **(1)** • Dichloromethane/PK2 / liquid solvent cement **(1)** • Cyanoacrylate /super Glue **(1)** **(1 x 1)**	**(1)**
5(b)	Any **Three** of the following points in an appropriate order. • Apply to surface. **(1)** • Two pieces are clamp/rubbed together. **(1)** • Clean off excess with water. **(1)** • Leave to cure / dry. **(1)** ***[do not accept preparation steps or steps in an inappropriate order]*** **(1 x 3)**	**(3)**
5(c)	Any of the following: • Sets quickly **(1)** • No clamping needed **(1)** • Effective on a wide range of materials **(1)** • Sufficient strength for a model **(1)** • Good gap filler **(1)** • Parts do not have to be precisely made **(1)** • Available in transparent/clear form **(1)** • Does not detract from the looks of the model **(1)** • Can usually be easily peeled off/ removed allowing parts to be re-positioned **(1)** • Cheaper than other multi-material adhesives **(1)** • Does not require mixing **(1)** • Water resistant **(1)** **(1 x 4)**	**(4)**

5(d)	Any **two** of the following with a linked relevant explanation: • **Risk** – Fumes given off can be inhaled causing dizziness / nausea / breathing difficulties / carcinogenic **(1)** • **Control** - Work in a well ventilated environment / only use for short periods / wear face mask / respirator / breathing equipment. **(1)** **[Do not accept wear dust mask as this offers no protection against fumes.]** • **Risk** – Exposure /splashes can cause rashes on skin / burns. **(1)** • **Control - W**ear protective clothes /gloves / barrier cream / wash after use. **(1)** • **Risk** – Exposure /splashes can cause eye irritation / injury. **(1)** • **Control -** Wear goggles / face shield. **(1)** • **Risk** - Fumes can be flammable **(1)** • **Control** - Ensure there are no naked flames / risks of ignition / sparks in the vicinity. **(1)** • **Risk** - Heat increases rate of vaporization **(1)** • **Control -** Avoid working in a hot environment / be stored away from heat source / direct sunlight. **(1)** **[do not accept the same control measure twice]** **(2 x 2)**	**(4)**
	Total for question	**12**

Question Number	Answer	Mark
6	Any **four** of the following: • Can cut faster.**(1)** • Can cut with a higher level of accuracy / less human error **(1)** • Repetitive accuracy. **(1)** • Laser can run 24/7 with minimal labour. **(1)** • Fine kerf of laser wastes less material than router and miller cutters. **(1)** • Material is less likely to break as there are no cutting forces. **(1)** • Safer as laser is fully enclosed. **(1)** • Laser allows precise shape to be previewed on screen prior to cutting. **(1)** • Tooling does not need changing /become blunt. **(1)** • Can cut a wider range of materials (Including paper & card). **(1)** • Can cut more complex / intricate shapes (due to tiny kerf). **(1)** • Materials do not need clamping. **(1)** • No cutting fluids are required. **(1)** • Gives a finished edge on plastics / prevents fabrics fraying. **(1)** • No swarf to dispose of. **(1)** • Material less likely to crack due to tool-less technology. **(1)** **[do not accept any unqualified 'cheaper']** **(4 x 1)**	**(4)**
	Total for question	**4**

Question Number	Answer	Mark
7(a)	Any **two** of the following points: • Define /set standards for products and processes worldwide. **(1)** • Promote quality and safety in procedures /products by testing and certificating**. (1)** • Promote product /system compatibility. **(1)** • Encourage / facilitate international trade. **(1)** [ISO is not an enforcement body. Do not accept responses that focus on **regulating, enforcing, ensuring** safe standards and quality in all products. Accept responses that **encourage, promote** safe standards and quality in product, or regulate products that claim compliance.] **(2 x 1)**	**(2)**
7(b)	Any **three** of the following with a linked relevant explanation: • Systems to check the design and development of the product. **(1)** • Destructive and non-destructive testing / works effectively/ meets specification. **(1)** • Systems to check raw material quality. **(1)** • Sample testing / material reach expected standard /not sub-standard. **(1)** • Systems to check the manufacturing processes / quality control. **(1)** • Checking the size/ finish/ function so ensuring components /products are manufactured to the required standard.**(1)** • Customer support department to check customer satisfaction **(1)** • Deals with customer feedback/ faulty products / honour guarantees **(1)** **(3 x 2)**	**(6)**
	Total for question	**8**

Question Number	Answer	Mark
8	Any **eight** of the following, but must include at least one disadvantage : Advantages • Large demand for the cans. **(1)** • Fast production rate. **(1)** • Running 24/7 increases volume of production. **(1)** • Minimal labour costs. **(1)** • Low unit costs lead to cheap products. **(1)** • Minimal wastage due to rigorous QC systems. **(1)** • Material costs can be minimized due to economies of scale / bulk buying. **(1)** • Design rarely changes so no need for expensive flexibility or changes in manufacturing systems. **(1)** • Simple design of product lends itself to automated manufacture. **(1)** • Initial investment quickly recovered enabling business to move into profit .**(1)** Disadvantages • Initial setup costs are large due to necessity of automated machinery.**(1)** • Automated machinery is inflexible so updating design is difficult to accommodate. **(1)** Maximum 7 marks if only advantages given. **(8 x 1)**	**(8)**
	Total for question	**8**

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