



GCE A LEVEL MARKING SCHEME

SUMMER 2019

**A LEVEL (NEW)
DESIGN AND TECHNOLOGY - UNIT 3
ENGINEERING DESIGN
1601U30-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

**GCE A LEVEL (NEW)
DESIGN AND TECHNOLOGY**

UNIT 3 - ENGINEERING DESIGN

SUMMER 2019 MARK SCHEME

Question 1		AO3	AO4	Mark
(a)	Describe three health and safety considerations when using the PCB drill.		✓	3x[1]
	<p><i>Answers that indicate an understanding of the potential hazards of using the PCB drill should be awarded 1 mark each based on:</i></p> <p>Guidance: Any health and safety issue that needs to be considered before or during drilling the PCB. This could relate to the trailing lead from power supply, securing drill in holder, holding the PCB securely, lowering drill so that only the PCB and not user's fingers can fit under the drill.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Clear identification of an appropriate health and safety consideration</p> <ul style="list-style-type: none"> • Hold PCB securely when drilling to prevent pcb being thrown out from drill • Using a waste layer of material on top of base of drill so drill bit will not drill into metal base / possible snap • Lower drill head so that the distance / clearance is around 10mm, so that users finger / hand cannot fit under drill. 			0 1 1 1
(b)	Produce a five step risk assessment for the student when using the disc sander shown to reduce the size of the PCB.		✓	5x[1]
	<p><i>Answers that indicate an understanding of the standard five step risk assessment and applying this process to the use of the disc sander to reduce the pcb. Some marks may still be awarded if points are incorrectly ordered but content is correct, albeit a reduced mark.</i></p> <p>No answer or no relevant information presented or discussed.</p> <p>Clear identification of correct risk assessment stage in the correct order:</p> <ol style="list-style-type: none"> 1. Identify the risk or hazard that may cause harm 2. Identify who may be at risk or harmed and how this may occur 3. Assess the risks and take action, this may include steps to reduce the risks. 4. Record findings using appropriate documentation. 5. Review risks assessment regularly, especially if changes occur. 			0 1 1 1 1 1
Total				8

Question 2

		AO3	AO4	Mark
(i)	Explain the meaning of the BSi mark featured on this product.		✓	2
	<p><i>Answers that reflect an understanding of the British Standards Institution, or the kitemark symbol and the meaning of this symbol displayed on a product.</i></p> <p>Guidance: The BSi logo is known as the kitemark. This symbol can be applied to a product that is approved by the BSi body for use in Britain / UK.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response BSi stands for British Standards Institution and indicates that the product is safe for the consumer.</p> <p>More detailed response with clear understanding The BSi mark represents the British Standards Institution and confirms that the product has been certified safe for the UK market.</p>			0
				1
				2
(ii)	Explain how the manufacturer of this product achieves the BSi mark.		✓	2
	<p><i>Answers that demonstrate how a manufacturer can display the BSi kitemark logo on their product.</i></p> <p>Guidance: <i>The product needs to be tested / repeatedly tested against the set guidelines in order to establish the fitness for purpose of the particular product.</i></p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response BSi mark is awarded once testing has been successful.</p> <p>More detailed response with clear understanding The BSi mark confirms that a product or service has been thoroughly tested and checked, time and again, and proven to meet a recognized BSi standard.</p>			0
				1
				2

Question 2

		AO3	AO4	Mark
(iii)	Explain two benefits to the consumer of purchasing the fire extinguisher with the BSi mark as shown.		✓	4
<p><i>Answers that relate to benefits for the consumer should be awarded 2 x [2] marks.</i></p> <p>Guidance:</p> <ul style="list-style-type: none"> • Consumers will know that manufacturers have checked that these products meet UK safety, health or environmental requirements. • Reassurance of a product's compliance with UK legislation • Allows the free movement of products within the UK market which might promote competition and lower purchase prices for consumers • Candidates may identify other considerations <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response</p> <p>The consumer knows that the product is safe for use.</p> <p>More detailed response</p> <p>The consumer is assured of the product's standard as a result of this approval. Consumers will know that the product is safe, fit for purpose and meets the applicable industry standards for this product or service.</p>				0
				1
				2
			Total	8

Question 3

		AO3	AO4	Mark
(a)	The household controller is intended to be stylish and minimalistic. Explain how this has been achieved.		✓	2
	Answers relating to understanding how the controller is stylish and minimalistic should be awarded with up to 2 marks. Guidance: Candidates may identify other considerations which may include: <ul style="list-style-type: none">• Simple interface with 4 buttons not to be too difficult to operate.• Small, slim-line and pocket size product easy to carry or move from room to room at home.• Similar to smart phones / tablet devices, similar 'style' in terms of aesthetics and also intended use.• Large illuminated screen with pictures / images to give user feedback.			
	No answer or no relevant information presented or discussed.			0
	Simplistic or basic response The concept is thin / slim, digital display screen and input buttons are well laid out			1
	More detailed response The concept looks very sophisticated in shape with a very elegant form. There are limited buttons providing a clutter free interface for the user. The large screen clearly gives important information to the user. The colour scheme would fit in most rooms / homes.			2

Question 3

		AO3	AO4	Mark
(b)	Describe the type of information that this research would provide and explain how this information would be of value to the designer.		✓	3
	<p>Answers relating to the understanding of anthropometric data research and its importance when designing the household controller should be awarded up to 3 marks.</p> <p>Guidance: Candidates may make reference to responses including:</p> <ul style="list-style-type: none"> • Anthropometric data would need to be considered to ensure the user's fingers can access the function buttons. • The screen size and angle / position would need to be clearly visible by the target market. • Weight and dimensions of controller would be dictated by anthropometric data of user's hand size. This is a portable and multi-positioning product. • Anthropometric data would lead the designer to incorporate ergonomic rules for the success of the household controller. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The information would provide details of the body sizes of the target market</p> <p>More detailed response The information would be numerical data based on the size / measurements of hands / fingers of the target market so that the size of the concept would fit the target market.</p> <p>Fully detailed response The information would ensure that the designer would know the anthropometric data and use ergonomic principles so that the concept would be the correct size to fit 95% / percentile. This would ensure that the product was comfortable for the user to hold and successful to interact with.</p>			0 1 2 3

Question 3

		AO3	AO4	Mark
(c)	Describe two advantages to the designer of using Computer Aided Design (CAD) during the development of the device.		✓	2x[2]
	<p>Answers relating to advantages of using CAD to develop the household controller should be awarded up to 2 x [2] marks. Do not reward the same response twice.</p> <p>Guidance: Candidates may identify other advantages which may include:</p> <ul style="list-style-type: none"> • The ability to generate CAM / CNC / rapid prototypes and have physical models to test. • Use of CAD to provide clients with proposals / visuals. • CAD files can be emailed globally – increasing efficiency during design and development. • CAD files being saved and accessed at different times / locations. • CAD software providing de-bugging, diagnostic information, feedback and performance analysis to allow the designer to evaluate an idea or concept. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response CAD can speed up the development process because changes are easier to make.</p> <p>More detailed response CAD allows the designer to visualise design ideas quickly, to test ideas and to develop proposals by modifying ideas as required.</p>			<p>0</p> <p>1</p> <p>2</p>

Question 3

		AO3	AO4	Mark
(d)	Explain the impact that modern materials and technology has had on the development of the electronic device.		✓	3
	<p>Answers relating to the impact of modern materials and technology on the development of the product including the casing, wireless connectivity, smart phone app, interfacing, remote controllability should be awarded up to 3 marks. Responses can be one factor in-depth, or multiple factors with less depth and still access the full 3 marks.</p> <p>Guidance: Candidates may identify other considerations which may include:</p> <ul style="list-style-type: none"> • Simple interfacing using wireless technology, compatibility with smart phones / devices and home networks • Small, slim line and pocket size product easy to carry / move around the home. • Similar to smart phones / tablet devices, similar 'style' in terms of aesthetics and also intended use. • Limited (4) tactile buttons, one large screen to view information. • Power supplies including lithium or ion which can be recharged to provide the concept with sufficient power / portability. • Materials such as ABS or PLA which could be used for the casing • Wi-Fi components to allow interfacing between other products including the boiler. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response Modern materials allows the product to be smaller / thinner due to component size.</p> <p>More detailed response Modern materials like TFT (thin film Transistors) or LED technology had allowed products to be minimised in size and also increase the quality of the output e.g. clearer image / sharper resolution. Improved battery technology to power the remote device.</p> <p>Fully detailed response Modern materials like TFT or LED technology had allowed products to be minimised in size and also increase the quality of the output e.g. clearer image / sharper resolution. Improved battery technology to power the remote device. Advanced component technology providing connectivity across Wi-Fi and domestic cable networks using multiple devices remotely.</p>			0 1 2 3
Total				12

Question 4

		AO3	AO4	Mark
(a)	Describe the most suitable scale of production for the new cordless screwdriver.		✓	3
	Answers that include and / or describe one-off production / bespoke production. Guidance: <ul style="list-style-type: none">• One off production will be the most appropriate because there is only one product• This will be labour intensive because manufacture will be done by hand• It would be inappropriate to automate production for one product.			
	No answer or no relevant information presented or discussed.			0
	One off production / bespoke named Or Basic description One product is made so one off production.			1
	Simplistic or basic response The screw driver is a proposal which has been presented prior to production so only one will be made.			2
	A more detailed response The new cordless screw driver is at the final concept stage, being presented prior to embarking on full scale industrial manufacture, therefore only one will be made, by hand, to finalise the new product.			3

Question 4

		AO3	AO4	Mark
(b) (i)	Explain how the new screwdriver could be considered more sustainable than the existing cordless screwdriver.		✓	2
	<p>Answers relating to the new screwdriver being more sustainable than the existing product should be awarded up to 2 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • The new screw driver is smaller in size, therefore uses less materials. (injection moulded ABS or similar) • Reduction in polymer use / plastics are bad for the environment and difficult to dispose of. • The built in battery cannot be interchanged – therefore there will be no spare / extra batteries reducing materials. • The new product is smaller, enabling more products to be shipped / transported saving carbon footprint. • The battery is inside the main casing reducing additional materials. • Less energy will be used because there will not be a spare battery on charge while the drill is being used. • No additional battery to dispose of at the end of its life. • No need to manufacture charger / dock. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The new cordless screw driver will only require one battery, the current model can be used with additional / spare batteries.</p> <p>More detailed response Only one battery is required so there is 50% less materials / energy required to produce this when compared to the current model.</p>			0
				1
				2

Question 4

		AO3	AO4	Mark
(ii)	Describe one disadvantage of having a built in battery.		✓	2
	<p>Answers relating to any disadvantage of having a built-in batter in the new screw driver should be awarded up to 2 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • The battery is inside and will be difficult to replace with a new one. • The manufacturer will have to replace or repair the whole screwdriver if there is a fault, rather than replace a detachable battery as in previous models. • The user will not be able to replace a dead / exhausted battery with a new one. • The user will have to stop working with the screwdriver when it runs out, until it is recharged. • The manufacturer will lose profit made by selling additional batteries. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The screw driver will not be fit for use when the battery requires recharging</p> <p>More detailed response Once the battery is flat, the screw driver will require charging before next use therefore creating a time delay rendering the product unusable.</p>			0 1 2

Question 4

		AO3	AO4	Mark
(c)	Describe the impact on the manufacturer of adopting this approach when producing the new cordless screwdriver in high volume.		✓	2
	<p>Answers relating to any advantage to the manufacturer of using bought-in standard components should be awarded up to 2 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • The QA of the bought in parts is high / reliability. • Reliance on another supplier to provide components / parts. • JIT Just in time provides advantages in no stock to manage, no room required for storage. • Cheaper than setting up a production line / equipment to manufacture the bought in parts in house. • Overall production costs will be lower if buying in bulk, so RRP could be lower / profit margin higher. • Reduce lead in time to get products to market quicker. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The manufacturer will be able to make products quicker because the mains adapters are bought in ready assembled.</p> <p>More detailed response Production is more efficient because there are fewer parts to manufacture; using bought in parts increases the rate of production.</p>			0
				1
				2

Question 4

		AO3	AO4	Mark	
(d)	When releasing the new cordless screwdriver into the market, the manufacturer must consider product support and customer services. Explain the impact product support and customer services will have on the success of the product in the marketplace.		✓	3	
<p>Answers relating to the impact product support and customer services will have on the success of the product in the marketplace should be awarded up to 3 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • Product support is critical to ensure that users can seek support in order to use the product correctly. • Product support is useful if there is a problem with the product. • Product support is important to ensure the customer receives guidance during or after purchasing the product, including during the warranty period. • Product support are available instantly via email or telephone to provide assistance to customers. • Customer relations are important to ensure the consumers are happy with the products. • Customer services are the main, sometimes only, contact between the customer and the company. • Effective customer services ensures customer loyalty and returning customers to purchase further products. • Customer services can boost confidence that customers have in companies, improving the brand / profile of the product and / or company. • Effective support can lead to increased sales where customers are happy with products and services and recommend these to others. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The manufacturer will have better customer relations if there is support in place when the product is sold.</p> <p>More detailed response The manufacturer would need to provide customer support to ensure that the product is received and it use / function is understood by all consumers.</p> <p>A clear and detailed response The manufacturer would need to provide customer support to ensure that the product is received and it use / function is understood by all consumers. This would ensure that the product is used correctly and safely without damaging the product. The support provided will also ensure future brand loyalty and positive reputation / reviews.</p>					
Total				12	

Question 5

		AO3	AO4	Mark
(i)	Describe how the input to this system functions.		✓	2
	<p>Answers relating to the role of the IR sensor receiving a unique signal from the transmitted in the handset remote in order to trigger the opening, closing or pausing of the gates. For receiving signals sent by remote transmitter you need only TSOP1738. Connect 5V to Vs and Ground to GND pin of TSOP1738. The output will be active low. Output of TSOP1738 will be HIGH when no signals fall on it and the output will be LOW when 38KHz infrared rays fall on it.</p> <p>Accept responses that include a signal from the remote control at the correct frequency – this is determined by either binary inputs or programming. A range of users can possess different remote controls that operate the gates at the same frequency.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response The input is an infrared sensor that detects a signal from a remote control transmitter</p> <p>More detailed response The input is an infra-red receiver / sensor which activates the transistor when a signal from a pre-set remote control handset is transmitted. The sensor will control the motorised output to open, close or pause the gates.</p>			0
				1
				2
(ii)	Explain the reason for the component labelled C1 .		✓	2
	<p>Answers relating to the reason for C1 allowing a smooth signal should be awarded up to 2 marks.</p> <p>Guidance: C1 is a capacitor, providing a smoothing effect to regulate the signal and provide a more stable, less erratic signal if it was not present.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response C1 is a capacitor and is added to improve the signal to the transistor.</p> <p>More detailed response C1 is a smoothing capacitor, which will prevent an erratic signal and ensure a stable and consistent voltage to the base of the transistor.</p>			0
				1
				2

Question 5

		AO3	AO4	Mark
<i>(iii)</i>	Explain, using notes and sketches, how you would add a relay switch with a 240volt power supply and motor to the circuit above to operate the sliding electric gate.		✓	4
	<p>Answers need to contain notes and sketches and explain in detail how a relay switch could be connected to the circuit.</p> <p>Guidance:</p> <p>The relay has three connections.</p> <ol style="list-style-type: none"> 1. The COM (common) needs to be connected to the +240V supply. 2. The NO (normally open) is connected to one side of the motor. 3. The NC (normally closed) is left free because this is when the relay is not magnetised (or off). 4. The motor symbol needs to be drawn correctly, with the +240V and -240V at either end. <p>A mixture of sketches and text can be expected where candidates may draw on the circuit provided or redraft part of the circuit to show the 240V and motor. Annotations / explanations should support responses.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response One correct convention / connection only. Very little technical understanding applied.</p> <p>Some detail Two correct conventions / connections evident. Some technical knowledge applied correctly.</p> <p>A detailed response Three correct conventions / connections evident. Technical knowledge applied well to add a 240V supply and motor to the existing circuit diagram.</p> <p>A clear and fully detailed response Three correct conventions /connections evident to use the relay to activate a 240V power supply. A motor with diode is also drawn / added correctly.</p>			<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>0</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p>
			Total	8

Question 6

		AO3	AO4	Mark
(i)	Describe the properties of a named polymer that make it suitable for the chassis of the toy car.		✓	2
	<p>Answers must relate to an appropriately named polymer. Properties of the correctly named polymer should be awarded up to 2 marks.</p> <p>Guidance. The named polymer is critical and must be present. The properties must relate to the named polymer, and must be appropriate for the chassis. These could include</p> <ul style="list-style-type: none"> • Lightweight • Durable • Impact resistant • Waterproof, could be used outdoors • Resistant to chemicals • Flexible (2mm / 3mm) • High impact resistant (4mm / 5mm) • Easily cut/bent/scored • Personalised logo and branding printing available • Range of thicknesses, colours & sizes <p>Accept Polycarbonate or any other polymer that would be suitable.</p> <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response HIPS sheet because it is a flat lightweight material</p> <p>More detailed response HIPS is a lightweight, flat material able to accept components like the axle and motor mount.</p> <p>Or</p> <p>Correx is a tough, rigid, impact resistant material due to the twin walled ripple centred construction.</p> <p>Or</p> <p>Foamex is a very lightweight yet rigid material which can have other dissimilar materials bonded and bolted to it to form the toy car.</p>			0 1 2 2 2

Question 6

		AO3	AO4	Mark
(ii)	Explain in detail how the photovoltaic cell powers the toy car.		✓	3
	<p>Answers must relate to the function of the photovoltaic cell in creating DC using solar energy to power the toy car. Award up to 3 marks for this explanation.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • The photovoltaic cell absorbs solar energy. • The semi-conductor material within the PV cell converts this energy to DC. • When a conductor joins the two surfaces, a DC current is produced and can be used as a power supply for a small load. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response Solar energy from the sun is converted into electricity.</p> <p>More detailed response Solar energy from the sun is converted into voltage and current by semiconductor materials within the pv cell.</p> <p>A detailed and thorough response Solar energy from the sun is converted into voltage and current by semiconductor materials within the pv cell. When a connector, like a wire, joins the two surfaces a current of electricity occurs between the negative and positive sides and generate direct current (DC), which is generally used for small loads like the dc motor to drive the toy car.</p>			0
				1
				2
				3

Question 6

		AO3	AO4	Mark
(iii)	Explain how the process of injection moulding is used to manufacture the ABS motor mount.		✓	3
	<p>Answers should describe the process of injection moulding, and how this is used to manufacture the motor mount in ABS.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • Grey granules of ABS in pellet form are fed into a hopper. • ABS pellets are heated until soft / molten. • ABS is forced into motor mount mould cavity under pressure from the screw. • The ABS fills the cavity / mould to take the shape of the motor mount. • The shape can be cooled, naturally or artificially, and then the mould can be opened. • The shape can then be removed / ejected and the process repeated for volume production. <p>No answer or no relevant information presented or discussed. 0</p> <p>Simplistic or basic response Molten ABS is forced into a mould to take the shape of the mount. 1</p> <p>More detailed response ABS granules are heated and fed under pressure into the cavity of a mould to take the mount shape. 2</p> <p>A detailed and thorough response ABS granules are stored in a hopper and gravity fed into the heating chamber. Once molten, the ABS is forced into the cavity of the mould under pressure. It fills the mould taking the shape of the mount. It is then cooled and ejected from the mould. 3</p>			
			Total	8

Question 7

		AO3	AO4	Mark
(a) (i)	In the space below complete a block diagram for the control system of the illuminating armband.		✓	3
	<p>Answers showing INPUT – PROCESS – OUTPUT with applicable components for the armband can be awarded up to 3 marks.</p> <p>No answer or no relevant information presented or discussed. 0</p> <p>Basic / simplistic response which is partly correct. There may be incomplete blocks or components which are inappropriate. Some correct conventions. 1</p> <p>A more detailed response which is largely / mostly correct. Block diagram is drawn correctly with appropriate components in place. Minor errors may be evident. 2</p> <p>More detailed response which is fully correct. Block diagram is drawn accurately and components selected are appropriate. 3</p> <p style="text-align: center;"> Input – process – output On off switch transistor / microprocessor LEDs / bulb / light </p>			
(ii)	Explain how this block diagram will support the designer to develop the control system for the arm band.		✓	2
	<p>Answers relating to how the block diagram supports the designer can be awarded up to 2 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • Block diagrams can help break a complex system down into simpler parts. • Block diagrams can be helpful for the designer to design aspects of the control system in isolation of the whole system. • The designer can visualise the input, process and output for the system more clearly using block, rather than components / symbols / circuit diagrams. • The designer can substitute parts simply, which will support development. <p>No answer or no relevant information presented or discussed. 0</p> <p>More detailed response The block diagram splits the system into smaller parts. 1</p> <p>The block diagram breaks the control system down into smaller sub systems which can be dealt with in isolation by the designer, simplifying a complex system into multiple smaller ones. 2</p>			

Question 7

		AO3	AO4	Mark
(b) (i)	Identify two different parts of the children's play frame that experiences a bending force.		✓	2 x 1
	No answer or no relevant information presented or discussed.			0
	Correctly identified part Swing beam			1
	Or Slide			1
	Or Main Platform			1
(ii)	Explain the reason for including Part B in the children's play frame.		✓	3
	Answers relating to the reasons for part B should be awarded up to 3 marks.			
	Guidance: <ul style="list-style-type: none"> Part B is included to hold the end legs in the A frame shape. Part B is included to prevent the end legs from splaying apart. Part B is included to withstand tension and act as a 'stretcher' member. Part B adds triangulation to the end of the frame which holds rigid. 			
	No answer or no relevant information presented or discussed.			0
	Simplistic or basic response Part B makes the support stronger.			1
	Or Part B locks the two end legs together.			
	More detailed response Part B is a Tie which absorbs tension to support the end leg structure.			2
	Or Part B creates the 'A' frame which is a rigid and can bear the load in the play frame structure			
	Fully detailed response Part B is a 'stretcher' that is included to withstand a tension force to hold the two end legs together. The triangulation created by the A frame provides a solid, rigid structure.			3

Question 7

		AO3	AO4	Mark
(iii)	The designer wishes to extend the swing beam so that three swings replace the two swings shown above. Describe how the designer could do this, justifying any modifications.		✓	2
	<p>Answers relating to the extension of the swing beam should be awarded up to 2 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • A longer swing beam would result in 3 swings generating more bending, and dynamic forces when children are swinging. • A thicker section timber would be required. • A single at an appropriate interval across the length of the swing beam would add support. • Triangular supports at either end would add some support to the swing beam. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response A longer the swing beam would need to be added, but this would require extra support like thicker end legs.</p> <p>More detailed response Adding a longer swing beam with a thicker cross section. The End legs will need to increase in cross section. A pier could be added at a distance between the main platform and the end legs to provide additional support.</p>			0
				1
				2
			Total	12

Question 8

		AO3	AO4	Mark
(a) (i)	Describe why modelling an electronic control system, as shown in Example B , is important prior to full scale manufacture.		✓	2
	Answers relating to modelling, testing and prototyping CAD circuits to check their function should be awarded up to 2 marks.			
	<p>Guidance:</p> <ul style="list-style-type: none"> • CAD modelling allows designers to build, test, modify, and refine electronic circuits. • CAD modelling speeds up the development time for the control system. • CAD allows designers for performance test circuits, with virtual simulations. • CAD modelling can identify flaws / areas for improvement. 			
	No answer or no relevant information presented or discussed.			0
	Simplistic or basic response To make sure it works properly.			1
	More detailed response CAD modelling is critical to fully test and develop the electronic control system to ensure it is at optimum functionality prior to embarking on manufacture.			2
(ii)	Explain how the model in Example A is critical when calculating material and components costs for commercial manufacture.		✓	2
	Answers relating to the calculation of size, volume of the control system, and internal dimensions of products as a result of identifying control system specifics should be awarded up to 2 marks.			
	No answer or no relevant information presented or discussed.			0
	Simplistic or basic response The sizes of the pcb board and the number of components can be accounted for accurately.			1
	More detailed response The sizes of the pcb board required can be calculated exactly, along with a comprehensive list of the components to be populated. This information can be up scaled depending on scale of production.			2

Question 8

		AO3	AO4	Mark
(b) (i)	Describe how the use of a semi-automated production line will impact on productivity.		✓	4
	<p>Answers relating to the impact on productivity of a semi-automated production line should be awarded up to 2 marks.</p> <p>Guidance: There may be various other benefits including:</p> <ul style="list-style-type: none"> • <u>Reduction in production time</u> – having a machine that is automated definitely speeds up the production time since no thinking is needed by the machine, there is better repeatability, and less human error. • <u>Increase in accuracy and repeatability</u> – when an automated machine is programmed to perform a task over and over again, the accuracy and repeatability compared to an employee is far greater. • <u>Less human error</u> – no one is perfect, and we are all prone to making mistakes. This is why a machine that performs repeated tasks is less likely to make mistakes than an employee. • <u>Less employee costs</u> – by adding automated machines to an operation, means less employees are needed to get the job done. It also indicates less safety issues, which leads to financial savings. With having less employees, there are numerous costs that are diminished or reduced such as payroll, benefits, sick days, etc. • <u>Increased safety</u> – having automated machines means having less employees who perform tasks that can be dangerous and prone to injury, which can make the work environment safer. • <u>Higher volume production</u> – investing in automated equipment creates a valuable resource for large production volumes, which in turn, will increase profitability. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response Productivity will be faster because automated machines work quickly / quicker than manual workers.</p> <p>More detailed response Productivity rates will be higher, and the quality of the product will be higher, because machinery works quicker than manual workers with no errors or defects.</p>			0 1 2

Question 8

		AO3	AO4	Mark
(ii)	Explain how using JIT manufacture to produce the printed circuit boards will benefit both the manufacturer and the end user.		✓	4
	<p>Answers relating to JIT and how this will benefit the manufacturer and the end user should be awarded up to 2 marks x 2.</p> <p>Guidance:</p> <p>The manufacturer will benefit because:</p> <ul style="list-style-type: none"> • Items will be ordered to arrive when required; this will be cost efficient and save storage space. • No surplus parts / unlikely to have any unwanted parts / components. • JIT can lower production costs, this could be passed on to the end user. • JIT helps to prevent surplus products or materials as production stops as soon as demand stops. • Waste levels can decrease as a result of need / demand being met and not exceeded. • Production errors / mistakes can be spotted more quickly, resulting in higher quality production. <p>The consumer will benefit because:</p> <ul style="list-style-type: none"> • Products are more likely to be error free and of a higher quality. • Products will have a lower retail price to purchase because JIT helps keep costs down. • Products will be available providing there is demand. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response for manufacturer benefit JIT is Just In Time manufacturing. This will ensure that stock components and materials are ordered and delivered when required, to reduce unnecessary stock and costs.</p> <p>More detailed response for both manufacturer and end user. JIT insures that the manufacturer always has a buyer for the product, and the customer will always have access to the product needed.</p> <p>Detailed response covering both manufacturer and end user JIT allows manufacturer to ensure that there is always a buyer for any item produced, keeping inventories low. Using the JIT business strategy means that manufacturers produce each item as it is ordered. If there are no customers wanting to purchase an item, production stops.</p> <p>Fully detailed response covering both manufacturer and end user JIT allows manufacturer to ensure that there is always a buyer for any item produced, keeping inventories low. Using the JIT business strategy means that manufacturers produce each item as it is ordered. If there are no customers wanting to purchase an item, production stops. There are never any surplus items to take up warehouse space. End users always get a new, up to date product, and obsolete products never occur.</p> <p>JIT production strategy is advantageous to a company's profitability in many other ways. Sales-contingent production means lower costs for both raw materials and labour. If a business is not looking to produce a backlog of goods for sale, it need only purchase those materials required for items that have already been ordered</p>			0
				1
				2
				3
				4

Question 9

		AO3	AO4	Mark
(a)	Analyse how the features of a product contribute to making a design classic.	✓		4
	<p>Answers relating to analysing the features that contribute to making a product a design classic should be awarded up to 4 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • Clear identification that the features of a design classic are timeless. • Design classic products stand the test of time, many are revitalised but retain features that are identifiable from previous products. • Design classics serve as a standard of their time. • Aesthetic features or values render the classic above / beyond their competitors. • Products 'raised the bar' and presented something special compared to the norm. <p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response with some knowledge and understanding of design classic status.</p> <p>A More developed / detailed response with evidence of clear understanding of how the features of a product contribute to the design classic status. Analysis reflects high level knowledge and / or examples are fully justified.</p>			<p>0</p> <p>1-2</p> <p>3-4</p>

Question 9

		AO3	AO4	Mark
(b)	Analyse how historical influences can be seen in the developments of the products shown below.	✓		4
	<p>Answers relating to analysing the historical influences through the developments of the telephones shown should be awarded up to 4 marks.</p> <p>Guidance:</p> <ul style="list-style-type: none"> • The handset is clearly detachable from the base, but not wireless until modern times. The cord has now vanished. • The rectangular base shape has remained consistent throughout time, with some reduction from 1930's to 1980's. The rectangle is much slimmer and more minimised in the current telephone. • Buttons / input features have remained circular, rotary initially, then push, now touch screen reflecting technological advancement. • The handsets remain largely rectangular forms. • Dark / black colours dominate the products providing a standard, particularly with the detachable handset • All products retain a shiny, glossy and sophisticated appearance. • Many edges on all three telephones are curved, rounded to soften sharp edges. • All three designs comprise geometric shapes and forms, merged together with simplicity. <p>No answer or no relevant information presented or discussed.</p> <p>Brief description with little detail in the historical influences. Simplistic or basic knowledge is evident, with basic levels of terminology and subject language.</p> <p>Detailed descriptions with clear explanation of the historical influences. Clear understanding and knowledge is evident, together with effective technical language and terminology.</p>			0
				1-2
				3-4
		Total		8

Question 10

	AO3	AO4	Mark
Evaluate the environmental factors of using this composite material.	✓		12
<p>Answers relating to environmental factors should be awarded up to 12 marks. Guidance:</p> <ul style="list-style-type: none"> • The composite material requires no finishing, maintenance or upkeep. This may benefit the customer because once the initial investment is made, no further costs will be incurred. This may be a negative for the manufacturer who could make more money from selling cleaning / preservative products. • Using a polymer will provide a water resistant and weather resistant finish requiring no further attention (other than occasional cleaning). This will be maintenance free for the consumer. • Once installed, the decking will require no attention for the rest of its useful life. The composite provides long lasting corrosion resistance material requiring no sealing, painting or treatments. • The composite material offers a long-life solution for the consumer. This will be positive for the consumer. The manufacturer will make profit from installing the composite decking which will be positive. • The composite is likely to be more expensive to purchase and install for the consumer due to the processing involved and the expected life. • The manufacturer must be confident of a high-quality product due to the 25 year guarantee. • Any defects or issues in service will require attention for a long period after installation. This will be peace of mind for the consumer and is likely to ensure a reliable and high quality product. • The consumer will face an expensive purchase, but the high-quality product is expected to last significantly longer than alternatives. • The composite material offers a long-life solution for the consumer and no additional costs for 25 years. • Morally / ethically the composite is a very positive sustainable option which supports environmental friendliness. • The decking is unlikely to present the same hazards e.g. slippery / mouldy when wet and is therefore a safer product for the consumer. • The composite is manufactured from waste materials, reducing waste and re-using discarded products. • Using the composite prevents using / depleting timber sources, and saves cutting, processing and transportation costs. • Despite requiring processing and adding agents, the decking uses waste and therefore reduces landfill and produces a sustainably product. • The product is expected to last for 25 years and is produced largely from 2 waste products. • As a combination of reducing waste, and longevity, the addition of colour dye and adhesives are outweighed by the waste reduction and reusing of problematic polymers e.g. milk containers HDPE. • Carbon negative implies that the product saves potential carbon emissions being released into the environment, and even contributes to reducing carbon levels. 			

	<ul style="list-style-type: none"> • Factors such as the number of trees that would be cut down to create decking could be considered, along with the oxygen / carbon dioxide consumption / pollution factors. • Carbon negative implies that the product saves potential carbon emissions being released into the environment and the waste generated by sawmills and milk containers being ‘thrown away’ or recycling with energy costs. • The composite decking replacing natural material and has a greater life expectancy, at the end of which it can be fully recycled once more. • A carbon negative product would need to have a net effect of reducing or removing carbon dioxide from the environment / atmosphere rather than adding to it. • Creating a cradle to cradle effect. • This process would need to account for all significant materials, transport, energy use and packaging inputs of creating the composite decking. 	
	<p>No answer or no relevant information presented or discussed.</p> <p>Simplistic or basic response demonstrating limited understanding and knowledge of the impact of using the composite for either the consumer or manufacturer.</p> <p>Limited or basic knowledge of designing and making principles incorporating alternative sustainable materials. Quality of written communication is basic or limited, with errors in spelling, punctuation and grammar.</p> <p>A more detailed response and developed response identifying some sustainability issues resulting on the use of the composite for either / both the consumer and manufacturer. Some knowledge of designing and making principles incorporating alternative sustainable materials. Quality of written communication is good, with few errors in spelling, punctuation and grammar.</p> <p>A fully detailed response with excellent identification of sustainability issues impacting on both the consumer and manufacturer of using the composite. Excellent knowledge and understanding of designing and making principles incorporating sustainable materials. Quality of written communication is excellent, and almost error free.</p>	<p>0</p> <p>1-3</p> <p>4-6</p> <p>7-9</p> <p>10-12</p>
	Total	12