

# Markscheme

November 2018

Design technology

Higher level and standard level

Paper 2

13 pages

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**Section A**

Question			Answers	Notes	Total
1..	a	i	50% ✓	<i>Award [1] for stating the percentage of composite used in the production of a Boeing 787.</i>	<b>1</b>
1.	a	ii	low mass/weight ✓ requires less energy/fuel (to fly) ✓  high mass/weight ✓ requires more energy/fuel (to fly) ✓	<i>Award [1] for identifying a physical property that would have the greatest impact on the fuel consumption of a plane and [1] for a brief explanation.</i>  <i>(answer in brackets not required to award mark)</i>	<b>2</b>
1.	b	i	the properties of photochromatic glass allow it to tint/change opacity when exposed to (UV) light/the voltage is controlled ✓ which blocks the sunlight so that passengers are more comfortable/protected from sun glare/eliminating the need for physical shade/blind ✓	<i>Award [1] for identifying why photochromatic glass is an appropriate material for the windows of a Boeing 787 and [1] for a brief explanation.</i>  <i>Do not accept 'change colour'.</i>	<b>2</b>
1.	b	ii	magneto-rheostatic fluids change their viscosity when exposed to a magnetic field ✓ which means that the impact of landing can be reduced/made safer ✓	<i>Award [1] for identifying why magneto-rheostatic smart materials would be used in the landing gear of the Boeing 787 and [1] for a brief explanation.</i>	<b>2</b>

1.	c	i	<p>test the structural integrity/stresses of the wing ✓                      overcomes expensive performance testing/is more cost effective ✓                      test the aerodynamics under various conditions ✓                      test thermal exchange of interior/exterior under various conditions ✓                      the designer can quickly make changes to the CAD drawing to improve the design of the wing ✓</p>	<p><i>Award [1] for each advantage of using FEA analysis for the design of the Boeing 787 wings.</i></p>	2
1.	c	ii	<p>instrumented models allow measurements to be taken that provide accurate/quantitative feedback for analysis ✓                      the wings on the 787 have been tested under various simulated conditions ✓                      this ensures that the wing can safely operate/resist stress during operation/improve the design ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how instrumented models have been used in the development of Boeing 787 wings.</i></p>	3

Question			Answers	Notes	Total
1.	d	i	it is lightweight ✓ which increases fuel efficiency/reduces the overall weight ✓  does not corrode ✓ as it is exposed to harsh environmental conditions ✓	Award [1] for identifying why an aluminium alloy would be used in the construction of the aircraft parts and [1] for a brief explanation.	2
1.	d	ii	lightweight ✓ improved stiffness ✓ increased resistance to corrosion ✓ resistance to creep ✓ high thermal resistance ✓ high mechanical strength ✓ increased durability ✓ high tensile strength ✓ good surface stability ✓	Award [1] for each reason why super alloys would be used in aircraft engines.  Do not accept 'strong'	2
1.	e	i	additive manufacturing is when materials are layered/fused/built up ✓ subtractive is wasting/cutting/machining/removal/abrading material ✓	Award [1] for each description of the difference between additive and subtractive manufacturing.	2
1.	e	ii	reduced wastage of materials ✓ reduced consumption of energy ✓ design changes can be easily adapted ✓ can make complex shapes; can make parts to high accuracy/precision; can be done faster than traditional methods of manufacture; reduces the number of processes required;	Award [1] for each advantage of using additive manufacture listed.  Do not accept 'less waste'	2

Question		Answers	Notes	Total
2.	a	wood (timber) chips/sawdust ✓ resin/adhesive/glue ✓	<i>Award [1] for each material used in the manufacture of particle board listed</i>	2
2.	b	lower material cost ✓ dimensionally stable/less likely to warp/twist/shrink ✓ consistent properties for machining ✓ raw materials easier to obtain/available ✓ more environmentally sustainable/uses waste wood ✓ available in large sheets ✓ range of finishes available ✓ reduced weight ✓	<i>Award [1] for each advantage for IKEA of manufacturing the Malm bed from particle board listed.</i> <i>Do not accept the following:</i> <i>'less expensive/cheaper'</i> <i>'environmentally friendly'</i>	2
3.		batch production ✓ because it is a limited volume production ✓ based on a set number of items to be produced / pre-determined production run ✓  batch production ✓ based on market demand ✓ makes the product more exclusive/keeps product price high ✓  batch production ✓ keeps production costs low/is affordable for a small company ✓ as less money is invested in machinery/automation/materials used are expensive ✓	<i>Award [1] for identifying an appropriate scale of manufacture for manufacturing the SL02 Mo bed and [2] for an explanation of why this scale of manufacture is appropriate.</i>	3
4.		brand protection / differentiate its business from its competitors ✓ to protect/ensure a revenue stream can be maintained / protect the value as an asset/retain customers ✓ prevent other companies from selling equivalent or inferior products/products with similar aesthetics/shape/appearance ✓	<i>Award [1] for each of three distinct points in an explanation of e15 would want to defend its design protection.</i>	3

**Section B**

Question		Answers	Notes	Total
5.	a	static / structural data based on the 5th-95th percentile range (adult males) ✓	<i>Award [1] for identifying how the nature of the anthropometric data that would have been collected for the Eames splint and [1] for a brief explanation.</i>  <i>(answer in brackets not required to award mark)</i>	2
5.	b	comfort/fatigue ✓ ensure that the splint fits well/the user feels less pain ✓ during the time they are wearing it ✓	<i>Award [1] for each of three distinct points in an explanation of the physiological factor the designers of the Eames splint would have considered in its development.</i>	3
5.	c	to test the process of manufacturing/lamination/construction ✓ to determine how the materials/manufacturing process affects the function ✓ and improve on the design based on feedback ✓  test the anthropometrics/size/shape ✓ to ensure the Eames splint fits the intended user ✓ to aid comfort/recovery/avoid injury ✓  test the locations of strap holes ✓ to ensure that the straps could be effective in various positions ✓ without affecting the structural integrity of the splint ✓	<i>Award [1] for each of three distinct points in an explanation of why prototypes would have been used in the development of the Eames splint.</i>  <i>Do not award marks across different clusters</i>	6

Question		Answers	Notes	Total
5.	d	<p>compressive strength ✓                      is the ability of the laminated plywood to withstand being pushed/squashed ✓                      the splint needs to withstand the weight of the limb whilst being supported ✓</p> <p>toughness ✓                      is the ability of the laminated plywood to absorb shock/impact without cracking/fracturing ✓                      protect from further injury to the limb during transportation/whilst moving/if dropped ✓</p> <p>tensile strength ✓                      Is the ability of the laminated plywood to withstand pulling forces ✓                      as the underside/bottom of the splint will be under tension when supporting a limb/ lifted by the straps ✓</p> <p>stiffness ✓                      is the resistance to deflection/bending of the laminated plywood by an applied force ✓                      to ensure the splint will retain its rigidity/shape ✓</p> <p>elasticity ✓                      the extent to which the laminated plywood will return to its original shape after being deformed/flexing ✓                      the splint should return to its original shape once the strapping is removed ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of a mechanical property of the laminated plywood that makes it suitable for use in the Eames splint.</i></p> <p><i>Do not award marks across different clusters</i></p> <p><i>Do not accept 'strong'.</i></p>	<b>9</b>



Question		Answers	Notes	Total
6.	a	<p>cost/price ✓ product is not released until the technology becomes affordable ✓</p> <p>social ✓ market is not yet ready for change ✓</p> <p>technology ✓ is not resolved sufficiently to introduce the product ✓</p> <p>timing ✓ products are introduced in a strategic order ✓</p>	<p><i>Award [1] for identifying why a technology may be shelved and [1] for a brief explanation.</i></p>	2
6.	b	<p>leading the competition ✓ before competitors develop rival products ✓ to gain a larger market share ✓</p> <p>increased profit ✓ as the product is the first of its type to be released on the market ✓ allowing the company to capture a large market share ✓</p> <p>secure brand loyalty ✓ ensuring that consumers are more likely to purchase the iPad ✓ so the product becomes the dominant design ✓</p> <p>secure IP ✓ prevent competitors from developing similar products ✓ enabling the iPad to become the dominant design ✓</p> <p>creating a new product category ✓ that creates a new market ✓ that allows Apple to become a market leader ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of one advantage to Apple of the iPad being first to market.</i></p> <p><i>Do not award marks across different clusters</i></p>	3

Question		Answers	Notes	Total
6	c	<p>relative advantage ✓                      how improved an innovation is over a previous version ✓                      individuals can see the advantages the iPad had over an iPhone or a laptop ✓</p> <p>compatibility ✓                      the level of compatibility that a product has to be assimilated into an individual's life ✓                      individuals can see that the iPad was compatible with their existing Apple products/needs ✓</p> <p>complexity ✓                      if an innovation is perceived as complex or difficult to use, an individual is unlikely to adopt it ✓                      individuals can easily understand how to use the product ✓</p> <p>observability ✓                      the extent to which an innovation is observable to others ✓                      individuals can see others using the iPad with positive feedback/marketing positively portrays the iPad ✓</p> <p>trialability ✓                      how easily an innovation may be explored/tested ✓                      Apple products in retail stores can be freely trialed ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how two of Rogers' characteristics apply to the consumer adaptation of the Apple iPad.</i></p> <p><i>Do not award marks across different clusters</i></p>	6

Question		Answers	Notes	Total
6	d	<p>dominant design ✓                      has all the features seen to be essential ✓                      the iPad has the function expected of a tablet/became the standard for all tablet design ✓</p> <p>defies obsolescence ✓                      the iPad was a breakthrough product, which set new standards ✓                      and has become iconic ✓</p> <p>omnipresent ✓                      the iPad is available or found almost everywhere ✓                      and has become part of everyday life ✓</p> <p>image ✓                      has instantly recognizable features/aesthetics ✓                      because of its distinctive shape/colour/branding/interface ✓</p> <p>status ✓                      ownership of the iPad can project a certain social status ✓                      making it a more desirable product ✓</p> <p>mass production ✓                      the iPad is produced in large numbers ✓                      making it a ubiquitous product ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of a characteristic that has led to the Apple iPad being considered a classic design.</i></p> <p><i>Do not award marks across different clusters</i></p>	9

Question		Answers	Notes	Total
7.	a	<p>small/minimal changes to the design/system (over time) ✓                      can lead to a more efficient/environmentally sustainable product/continuous improvement based on feedback from users ✓</p>	<p><i>Award [1] for identifying how the IDEO trolley is an example of incremental green design strategy and [1] for a brief explanation.</i>   <i>(answer in brackets not required to award mark)</i></p>	2
7.	b	<p>50th percentile ✓                      based on the average height/reach of the user ✓                      allowing the widest range of possible users to reach the handlebar ✓</p>	<p><i>Award [1] for identifying the percentile the designer has used for the fixed height of the handlebar and [2] for an explanation of why this scale of manufacture is appropriate.</i></p>	3
7.	c	<p>graphical modelling is used to communicate design ideas on paper/software (in 2 or 3 dimensions) ✓                      to clarify understanding to clients/consumers ✓                      which develops the concept/promotes creativity ✓</p> <p>physical modelling is used to provide a tangible representation of a design or system/that can be interacted with ✓                      which allows communication with a client/non-technical user/within a design team ✓                      and can be easily tested/modified/manipulated ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of why graphical modelling (3 max) and physical modelling (3 max) is used by designers in the development of the IDEO trolley.</i></p> <p><i>Do not award marks across different clusters</i></p>	6

Question		Answers	Notes	Total
7.	d	<p>reuse ✓ reuse of a product in the same context or in a different context ✓ the trolley can be reused by other people for water delivery/the trolley can be used for purposes other than delivering water ✓</p> <p>recycle ✓ using materials from obsolete products to create other products ✓ once the trolley becomes obsolete the materials/components can be recycled for other products ✓</p> <p>repair ✓ the ease of reconstruction or renewal of any part of an existing structure or device ✓ the trolley uses simple technology/locally available materials (tyres, wheels, frame) which makes it easy to repair ✓</p> <p>recondition ✓ rebuilding a product so it is in an as new condition ✓ the frame can be repainted/the wheels can have new bearings fitted so they run more efficiently ✓</p> <p>reengineer ✓ redesign components or products to improve their characteristics or performance ✓ the frame is easy/inexpensive to modify ✓</p> <p>dematerialisation ✓ is the reduction of total material and energy throughput of any product ✓ the frame is very basic/uses the bare minimum of materials needed ✓</p>	<p><i>Award [1] for each of three distinct points in an explanation of how the IDEO trolley uses waste mitigation strategies.</i></p> <p><i>Do not award marks across different clusters</i></p>	9