

# **GCE Design and Technology: Product Design (3-D Design)**

**PROD1**

**Unit 1      Materials, Components and Application**

**2015**

# **MARK SCHEME**

**Post Standardisation**

Question	Part	Sub Part	Marking guidance	Mark	Comments
1	(a)		Composite, fibre based composite.	1	
1	(b)		E.g. Canoe/boat hulls, racing car bodies, items of sports equipment such as tennis racquets, golf clubs, fishing rods, hockey sticks, bicycle frames etc.	1	1 mark for the application.  If no composite is named award zero marks.  If a composite other than CFRP or GRP is named with an application award zero marks.
1	(c)		Reasons should be explained referring to stated product. e.g. GRP for a boat hull. Manufactured via lay up method so complex 3d shapes such as the hull can be created. Can be pigmented to produce a range of colours for improved aesthetics. Chemical resistant so will not corrode/decay when in the salty sea or in a harbour with boat fuel. Tough material able to withstand minor impact from waves etc. Can be laid up and sanded which enables minor repairs to be made. Etc.	4	1-2 marks per relevant point.  Award second mark where point is explained.  If no composite or product named in part (b) award zero marks.  If a composite other than CFRP or GRP is named with a correct application in 1(b) award credit for relevant points in 1(c).

Question	Part	Sub Part	Marking guidance	Mark	Comments
2			Quality control methods such as: Inspection of the material for defects. Use of measuring devices and go/no go gauges. Use of drilling jigs/templates/CNC machining. Random sampling of products during manufacture. Use of welding jigs, assembly jigs. Failure testing. Etc.	2	1 mark per relevant point.  Accept references to quality assurance measures.

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3			Construction site safety sign <b>E</b> (Fluted polypropylene sheet) Sketching with inks, pencils <b>C</b> (Layout paper) Gift box outer packaging <b>A</b> (Metal effects card) Model making <b>B</b> (Styrofoam)	4	A letter can only be used once. No mark awarded to a repeated letter.

Question	Part	Sub Part	Marking guidance	Mark	Comments
4	(a)		A material that changes its physical properties in response to an input.	2	
4	(b)	(i)	E.g. Thermochromic pigment- baby feeding products, colour change mug/Thermocolour kettle etc. Thermochromic film- battery charge indicators, thermometers etc. Photochromatic pigment – sunglasses, anti-flash visors etc. Phosphorescent pigment- emergency exit signs, glow in the dark products etc. Polymorph – modelling grips etc. Shape Memory Alloy – flexible spectacles, muscle wires, dental brace wire, bone fixings, fire sprinklers etc. Etc.	2	1 mark for correct smart material, 1 mark for suitable application.  If no smart material and/or application named award zero marks.
4	(b)	(ii)	Expect reasons such as: E.g. Thermochromic film for thermometers: Changes colour in response to temperature change to indicate temperature such as red for hot. Colour change makes it easier to read than small numbers or lines. Non toxic material, much safer to use than mercury thermometers. Etc.	4	1-2 marks per relevant point.  Award second mark where point is explained.  If no smart material or application given in part (b) award zero marks.

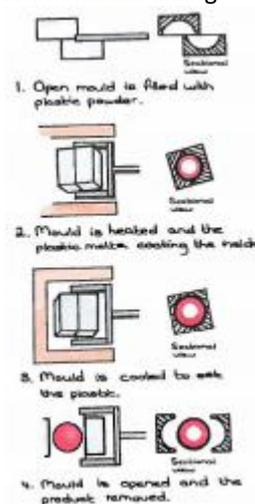
Question	Part	Sub Part	Marking guidance	Mark	Comments
5	(a)	(i)	Stainless steel, aluminium, chrome plated mild steel.	1	Do not accept references to stock form e.g. round bar = 0 marks.
5	(a)	(ii)	e.g. Available in round tubing which is suitable for the design. Malleable to be formed into the curved shape of the legs. Tough, will not dent if the rack falls over. Widely available, this is required for mass production such as needed to meet demand for hotel chain etc. Can be easily drilled with standard tooling to produce holes for the screws/pivot points Etc.	6	1-2 marks per relevant point. Award second mark where point is explained.  <b>Max 3 for a list of unexplained properties.</b>

Question	Part	Sub Part	Marking guidance	Mark	Comments
5	(a)	(iii)	Expect references to: Cutting the tubes to length Drilling holes for pivot points Bending jig/pipe bender to create curved parts Pop rivets or welding to join parts together Insertion of end caps. Etc.	9	Mark breakdown:  Simple description with little detail. Diagrams are basic. (0-3)  Better description and diagrams using correct terminology. (4-6)  Fully detailed descriptor with accompanying diagrams, correct tooling etc. (7-9)  <b>If no diagrams max 4 marks</b> <b>If no description max 4 marks</b>
5	(b)		Expect references to: Risk assessments being carried out. Provision of PPE. Provision of first aid kits. Appropriate training. Clearly marked fire exits. Marked walkways. Warning signs. Maintenance records and machine servicing. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained.  <b>Max 2 for an unexplained list of PPE.</b>

Question	Part	Sub Part	Marking guidance	Mark	Comments
6	(a)	(i)	e.g. Chemical resistance can be cleaned with detergent. Available in a wide range of colours and textures to imitate more expensive materials such as marble. Available in large sheet sizes for laminating onto chipboard for large work surface. Can be easily cut into with standard tools such as a jigsaw to cut out recesses for sinks. Heat resistant, hot pans can be placed onto the surface without damage. Water resistant, can withstand spills/cleaning without decay. Hard material to withstand scratches from knives/ when cutting vegetables. Etc.	8	1-2 marks per relevant point. Award second mark where point is explained.  <b>Max 4 for a list of unexplained properties.</b>

Question	Part	Sub Part	Marking guidance	Mark	Comments
6	(a)	(ii)	<p>e.g. Aesthetically pleasing due to open grain pattern and rich, reddish brown colour. Easy to cut with standard tooling such as band saws to enable legs and parts to be cut to shape. Tough material will be able to withstand items such as TV remote controls being dropped onto it. Can have finishes such as Danish oil/ polyurethane varnish applied to make water and heat resistant. Etc.</p>	8	<p>1-2 marks per relevant point. Award second mark where point is explained.</p> <p><b>Max 4 for a list of unexplained properties.</b></p>
6	(b)		<p>Advantages such as: Consistent thickness throughout the board. No grain problems. Available in large sheet sizes unlike solid timber. Not prone to defects such as warping, bowing etc. Less expensive than solid timber of a similar size. Utilises the entire tree therefore more environmentally friendly. Etc.</p>	4	<p>1-2 marks per relevant point. Award second mark where point is explained.</p>

Question	Part	Sub Part	Marking guidance	Mark	Comments
7	(a)	(i)	<p>E.g. HDPE is a thermoplastic that is suitable for rotational moulding which is the process used to create the hollow complex 3d shape. It is tough which means it can withstand considerable use and daily bumps. HDPE is lightweight which means children could easily move the chair around. It can be pigmented during the moulding process which means it can come in a range of colours and the colour will not wear off. Waterproof so it can be used outside. HDPE can have stabilisers added to make it resistant to sunlight/UV damage. HDPE is chemical resistant so can be cleaned with detergent. Accept reference to: hygienic, non toxic etc.</p>	6	<p>1-2 marks per relevant point. Award second mark where point is explained.</p> <p><b>Max 3 for list of unexplained properties.</b></p>

Question	Part	Sub Part	Marking guidance	Mark	Comments
7	(a)	(ii)	<p>Possible answers might include:</p> <p>Stabilisers (light stabilisers) help prevent the polymer from degrading due to exposure to sunlight.</p> <p>Stabilisers prevent the polymer colour fading/ discolouring due to exposure to UV.</p> <p>Exposure to UV rays can cause polymers to become brittle, stabilisers help to prevent this.</p> <p>Polymers are susceptible to degradation from UV rays, additives such as antioxidants or UV absorbers prevent degradation.</p> <p>Polymer chains can break down due to UV exposure and the product can crack, stabilisers prevent this.</p> <p>Etc.</p>	4	<p>1-2 marks per relevant point.</p> <p>Award second mark where point is explained.</p>
7	(a)	(iii)	<p>Rotational Moulding</p>  <p>1. Open mould is filled with plastic powder.</p> <p>2. Mould is heated and the plastic melts, coating the inside.</p> <p>3. Mould is cooled to set the plastic.</p> <p>4. Mould is opened and the product removed.</p> <p>Description:</p> <p>Stage 1- Measured amount of polymer powder and pigment is inserted into the open mould.</p> <p>Stage 2- mould is closed and rotated.</p> <p>Stage 3- mould moves into a heating chamber whilst rotation continues.</p> <p>Stage 4- polymer powder melts and builds up around the inside surface of the mould.</p> <p>Stage 5- mould moves into a cooling chamber, still rotating.</p> <p>Stage 6- polymer cools and product hardens.</p> <p>Stage 7- mould is opened and the product is removed.</p>	9	<p>Simple description with little detail. Diagrams are basic with incorrect labels or incomplete parts. (0 – 3 marks)</p> <p>Better description using correct terminology. Diagram mostly complete and correct (4 – 6 marks)</p> <p>Full description. Correct/complete diagram. Detail includes terminology (7 – 9 marks)</p> <p>For full marks the mould should resemble the product.</p>

Question	Part	Sub Part	Marking guidance	Mark	Comments
7	(a)	(iv)	<p>Expect references to:</p> <p>Toxic fumes from polymer.</p> <p>Use of fume extraction/ fully automated process.</p> <p>Molten polymer.</p> <p>Fully automated process, no human interaction.</p> <p>Heat from heating chamber.</p> <p>Machinery guarded to prevent being opened prior to cycle being complete.</p> <p>Safe zones in use to prevent employees entering the area when manufacture is in progress.</p> <p>Hot (warm) product post moulding.</p> <p>Use of PPE gloves, machinery guarded to prevent being opened prior to cycle being complete.</p>	4	<p>2 x 2 marks</p> <p>1 mark per hazard.</p> <p>1 mark for associated control measure.</p> <p>Hazard and control measure must be linked to attain 2 marks</p>
7	(b)		<p>Possible answers might include:</p> <p>Ears are quite pointed and could hurt the child.</p> <p>Ears could be bent over to provide a handle grip.</p> <p>Ears could have additional texture to help grip when getting onto the seat.</p> <p>Very smooth surface and the child could slip off. The seat could have a texture added.</p> <p>Wide seat could be uncomfortable if sitting facing the ears, seat could be narrower.</p> <p>Back rest is at the ears end so if child sits facing the ears they cannot lean back and relax.</p> <p>The seat is hard and uncomfortable to sit on because it does not have any cushioning. A soft cushion could be inserted into the seat to make it more comfortable.</p> <p>Addition of a tail for the child to pull the chair into place.</p> <p>Manufactured in green a colour which attracts the child to interact with the product.</p> <p>Seat is quite short, larger children may find it uncomfortable.</p> <p>Ears are rounded at the top so child's hand can grip around.</p> <p>Texture on seat gives some grip so that the child does not slip off.</p> <p>Child may face backwards and use the head and ear section as a back rest.</p> <p>Back rest section is upright, promoting good posture.</p> <p>Etc.</p>	9	<p>Breakdown:</p> <p>No diagrams and basic points without explanation. (0 – 3 marks)</p> <p>Basic diagrams. Some points explained with some evaluation. (4 – 6 marks)</p> <p>Good diagrams. Most points explained. Comments are evaluative. (7 – 9 marks)</p>

Question	Part	Sub Part	Marking guidance	Mark	Comments
7	(c)		<p>Possible answers might include:</p> <p><b>Additional play or learning features:</b>            Light up eyes, horn on ears or nose.            Mirrors for eyes or animal spots.            Integrated shape sorter or puzzle, animal noise game.            Voice activation for good posture when the child sits on it.            Use of smart materials such as polymorph or SMAs for ear grips, thermochromic pigment so it changes colour when the child sits on it, phosphorescent pigment to glow in the dark.            Pull along aspect so the child can take the animal for a walk.            Additional cover or coat with features such as buttons for children to practice with.            Additional shoes with laces for children to practice with.            Number racks/abacus for counting.</p> <p><b>N.B Candidates cannot re-design a whole new chair, it must resemble the original basic form.</b></p>	8	<p>Breakdown:</p> <p>Diagrams are basic and notes are limited. (0 – 2 marks)</p> <p>Better diagrams with some explanation in notes. (3 – 5 marks)</p> <p>Good diagrams with all relevant points explained. (6 – 8 marks)</p> <p><b>If product is a re-design and does not resemble original form, award zero marks.</b></p>