



# Mark Scheme (Results)

June 2015

NQF BTEC Level 1/Level 2 Firsts in  
Engineering  
Unit 38: Materials used in Engineered  
Products (20573G)

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Question Number	Answer	Mark
1 (a)	B – Ferrous Metal	1

Question Number	Answer	Mark
1 (b)	D – Transparency	1

Question Number	Answer	Mark
1 (c)	B – Electro-rheostatic fluid D – Piezoelectric material  <b>Accept no variation.</b>	2

Question Number	Answer	Mark
1 (d)	Award <b>one</b> mark for any of the following: <ul style="list-style-type: none"> <li>• The ability of a material to be shaped into something else without breaking (1)</li> <li>• The ability of a material to deform under pressure (1)</li> </ul> <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
1 (e)	A – corrosion resistance	1

Question Number	Answer	Mark
2 (a)	Award <b>one</b> mark for any of the following: <ul style="list-style-type: none"> <li>• Aluminium</li> <li>• Copper</li> <li>• Zinc</li> <li>• Tin</li> <li>• Magnesium</li> </ul> <p>Also accept the following:</p> <ul style="list-style-type: none"> <li>• Aluminium alloys</li> <li>• Duralumin</li> <li>• Brass</li> <li>• Bronze</li> </ul> <p>Accept any other named specific non-ferrous metal.</p>	1

Question Number	Answer	Mark
2 (b)	Marine  <b>Accept no variation.</b>	1

Question Number	Answer	Mark
2 (c)	B – Grain structure	1

Question Number	Answer	Mark
2 (d)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• annealing</li> <li>• hardening</li> <li>• tempering</li> <li>• quenching</li> <li>• specific/named types of hardening (e.g. case/flame/induction/precipitation etc.)</li> <li>• normalising</li> </ul> <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
2 (e)	C – Compressive strength	1

Question Number	Answer	Mark
3 (a)	B - Extraction	1

Question Number	Answer	Mark
3 (b)	C – Film	1

Question Number	Answer	Mark
3 (c)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• metal/metals</li> </ul> <p>also accept:</p> <ul style="list-style-type: none"> <li>• any appropriate named metal</li> <li>• shape memory alloys</li> </ul>	1

Question Number	Answer	Mark
3 (d)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• bitumen</li> <li>• solvent</li> <li>• tyres</li> <li>• soap</li> <li>• putty</li> <li>• linoleum</li> <li>• thermoplastics</li> <li>• thermosets</li> <li>• grease</li> </ul> <p>Do not accept any type of oil, petrol or diesel.</p>	1

Question Number	Answer	Mark
4 (a)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• Smart materials</li> <li>• Smart</li> </ul> <p>Accept other responses which define smart materials.</p>	1

Question Number	Answer	Mark
4 (b)	A - Brightness	1

Question Number	Answer	Mark
4 (c)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• Tensile strength (1)</li> <li>• Strength under tension (1)</li> <li>• Strength when being pulled (1)</li> </ul> <p>Accept any other appropriate response relating to tensile strength.</p>	1

Question Number	Answer	Mark
5 (a)	<p>Award <b>one</b> mark for any of the following, up to a maximum of <b>two</b> marks.</p> <ul style="list-style-type: none"> <li>• Galvanising/zinc plating (1)</li> <li>• Painting (1)</li> <li>• Plastic/dip coating (1)</li> <li>• Chrome plating (1)</li> </ul> <p>Accept any other appropriate response.</p> <p>Do not accept 'plating' as a second response if a named example of plating has been given.</p>	2

Question Number	Answer	Mark
5 (b)	<p>Award <b>one</b> mark for any of the following:</p> <ul style="list-style-type: none"> <li>• It restores a ferrous metal to its original condition</li> <li>• To make the ferrous metal more workable</li> <li>• Easier to drill/bend</li> <li>• Removes excessive hardness</li> <li>• To allow further processing to occur</li> <li>• To allow use of general tools (rather than specialist tools)</li> <li>• Prevents fracture during bending</li> </ul> <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
5 (c)	<p>A linked response, award <b>one</b> mark for identifying a reason and <b>one</b> additional mark for appropriate expansion, up to a maximum of <b>four</b> marks.</p> <p>The dish can be installed in a wide range of positions (1) because aluminium is relatively light in weight (1)</p> <p>The dish is easier to manufacture (1) because aluminium is easier to form into the dish shape than other metals (1)</p> <p>The dish will have a long working life (1) because aluminium does not rust (1)</p> <p>The dish size can be smaller (1) because aluminium reflects the microwave satellite signals efficiently (1)</p> <p>Using aluminium reduces the impact on the environment (1) as it is easier to recycle at the end of its usable lifespan (1)</p> <p>Accept any other appropriate response.</p>	4

Question Number	Answer	Mark
5 (d)	<p>A linked response, award <b>one</b> mark for identifying an advantage and <b>one</b> additional mark for appropriate expansion, up to a maximum of four marks.</p> <p>Batteries of the computer will last longer (1) since a quantum tunnelling composite screen only uses a very small current (1)</p> <p>It is possible to draw variable line widths/change colours/adjust settings according to the amount of pressure (1) because the screen can be sensitive to changes in pressure (1)</p> <p>Screens can be made much larger in size (1) because the screen uses less power than comparable capacitive touchscreens (1)</p> <p>There is no need for a constant supply of current (1) because different parts of the screen can be activated only when necessary (1)</p> <p>Accept any other appropriate response.</p>	4

Question Number	Answer	Mark
6 (a)	Indicator light lens – A (acrylic) Piston – D (aluminium)  <b>Accept no variation.</b>	2

Question Number	Answer	Mark
6 (b)	A linked response, award <b>one</b> mark for identifying a reason and <b>one</b> additional mark for appropriate expansion, up to a maximum of <b>two</b> marks.  Thermosetting plastics do not biodegrade (1) meaning the used car components could leach dangerous chemicals over time (1)  Thermoset plastics can contaminate materials for recycling (1) which will result in the new plastic having poorer qualities (1)  Thermoset plastics are toxic when burned (1) which will result in atmospheric pollution (1)  Thermosetting plastics need to be shredded/reclaimed (1) which limits disposal opportunity (1)  Accept any other appropriate response.	2

Question Number	Answer	Mark
7 (a)	Accept any one of the following <ul style="list-style-type: none"> <li>• Rubber</li> <li>• Silicone rubber</li> <li>• Natural rubber</li> <li>• Butadiene rubber</li> <li>• Butyl rubber</li> <li>• Thermoplastic elastomers</li> </ul> Accept any other appropriate response.	1

Question Number	Answer	Mark
7 (b)	<p>A linked response, award <b>one</b> mark for identifying a reason and <b>one</b> additional mark for appropriate expansion, up to a maximum of four marks.</p> <p>Complex/intricate/aerodynamic shaped mouldings can be produced (1) which can be produced in one single piece (1)</p> <p>It improves the power-weight ratio of the motorcycle (1) as glass fibre composites can be lighter in weight than metals (1)</p> <p>Colour pigments can be added (1) which removes the need for painting (1)</p> <p>Provides further protection to the rider/motorcycle (1) since it can be produced with higher strength (1)</p> <p>Accept any other appropriate response.</p>	4

Question Number	Answer	Mark
7 (c)	<p>A linked response, award <b>one</b> mark for identifying an advantage and <b>one</b> additional mark for appropriate expansion, up to a maximum of four marks.</p> <p>Polystyrene can be injection moulded/vacuum formed (1) allowing inserts/shelves to be included (1)</p> <p>Is resistant to stress cracks (1) which increases the life span of the product (1)</p> <p>Can withstand very low temperatures without the properties of the material changing (1) which means the panel retains its functionality (1)</p> <p>Able to be formed with a smooth glossy finish (1) which allows for easier cleaning (1)</p> <p>Will not alter the taste of the products stored inside (1) as it is inert (1)</p> <p>Allows for lightweight panels to be produced (1) which means the refrigerator will be easier to move into place/which makes the refrigerator accessible to less mobile individuals (1)</p> <p>Panels can be recycled (1) which allows for easier end of life disposal (1)</p> <p>Accept any other appropriate response.</p>	4

Question Number	Indicative content	Mark
8	<p>Judgement</p> <ul style="list-style-type: none"> <li>• Helicopter rotor blades need to be lightweight yet structurally rigid.</li> <li>• Using aluminium spars with an outer skin of aramid fibres reduces the overall weight of the rotor blades.</li> <li>• The stainless steel leading edges of the blades prevent damage if the rotor blades are hit by birds or other objects.</li> <li>• The materials are combined in such a way as to take advantage of the most useful properties of each</li> <li>• The materials are all resistant to weathering, therefore there is no need for painting/finishing which reduces the overall weight of the rotor blades.</li> <li>• The combination of materials are able to withstand extreme changes in temperature.</li> </ul> <p>Consideration for using aluminium</p> <ul style="list-style-type: none"> <li>• Aluminium has a high strength to weight ratio</li> <li>• Spars can be manufactured using a range of techniques</li> <li>• Does not add excessive weight to the rotor blades</li> </ul> <p>Consideration for using aramid fibres</p> <ul style="list-style-type: none"> <li>• High strength to weight ratio</li> <li>• Can be manufactured to have strength along the length of the rotor blade.</li> <li>• Is able to flex when subjected to forces in flight.</li> <li>• Unlikely to suffer from fatigue when in use.</li> </ul> <p>Consideration for using stainless steel</p> <ul style="list-style-type: none"> <li>• Stainless steel is weather/corrosion resistant</li> <li>• Can be made in thin sheets which do not add significant weight to the rotor blades.</li> <li>• Has excellent impact resistance.</li> </ul>	8

	<p><b>Model answer</b></p> <p>The helicopter rotor blades are made from a combination of materials because this reduces the weight of the overall blade and makes the helicopter more efficient. Each of the materials is resistant to weathering, this means there is no need to paint the blades. The spars are made from aluminium as this is relatively light in weight, but strong. These can be stamped or cast depending on the requirements of the helicopter. The skin is made from aramid fibres which despite being strong, they allow the rotor blades to flex when in flight and are therefore less likely to become damaged due to fatigue. The leading edges are made from stainless steel as this will absorb any impacts from birds in flight and will not lead to damage of the rotor blades.</p> <p>In conclusion, the blades are designed using these three materials in order to make best use of the properties each material whilst still ensuring that the rotor blades are strong and are not likely to break in flight.</p>	
Level	Descriptor	
0 0 marks	No rewardable material	
1 1-3 marks	A few key material properties identified, <b>or</b> one material described in some detail. The answer is likely to be in the form of a list. Only one material considered. Points made will be superficial/generic and not applied/directly linked to the design of rotor blades. The learner has a limited understanding of the materials.	
2 4-6 marks	Some material properties identified, <b>or</b> a few key properties of materials described. Consideration of more than one material but there will be more emphasis on one of them. The answer is unbalanced. Most material properties discussed will be relevant to the design of rotor blades, but the link will not always be clear. The learner has a good understanding of the materials.	
3 7-8 marks	Range of material properties described, <b>or</b> a few key properties explained in depth. All sides of the case are considered and the answer is well-balanced, giving weight to all considerations. The majority of points made will be relevant and there will be a clear link to the design of rotor blades. The learner has a developed understanding of the materials.	

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