



Mark Scheme (Results)

January 2017

NQF BTEC Level 1/Level 2 Firsts in
Engineering

Unit 38: Materials Used in Engineered
Products (20573G)

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BTEC Next Generation Mark Scheme Engineering Unit 38 1701

Question Number	Answer	Mark
1a	Award one mark for any of the following: <ul style="list-style-type: none"> • glass fibre (1) • carbon fibre (1) • aramid fibre (1) • Kevlar (1) • GRP (1) • CFRP (1) <p>Accept any other reasonable response.</p>	1

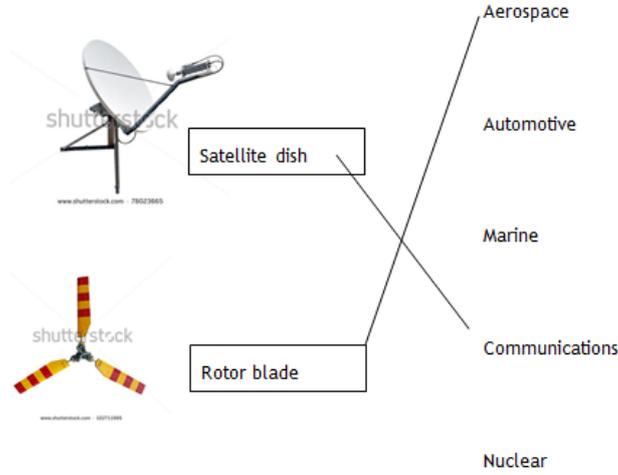
Question Number	Answer	Mark
1b	A – Carbon steel E – Cast iron	2

Question Number	Answer	Mark
1c	Award one mark for any of the following up to a maximum of two marks: <ul style="list-style-type: none"> • stainless steel (1) • duralumin (1) • brass (1) • bronze (1) • solder/ pewter (1) • amalgam (1) • nitinol (1) <p>Accept any other reasonable response.</p>	2

Question Number	Answer	Mark
1d	C – Mass D - Opacity	2

Question Number	Answer	Mark
1e	<p>Award one mark for the following:</p> <ul style="list-style-type: none"> • stiffness • rigidity • not flexible <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark
2a	B – mining	1

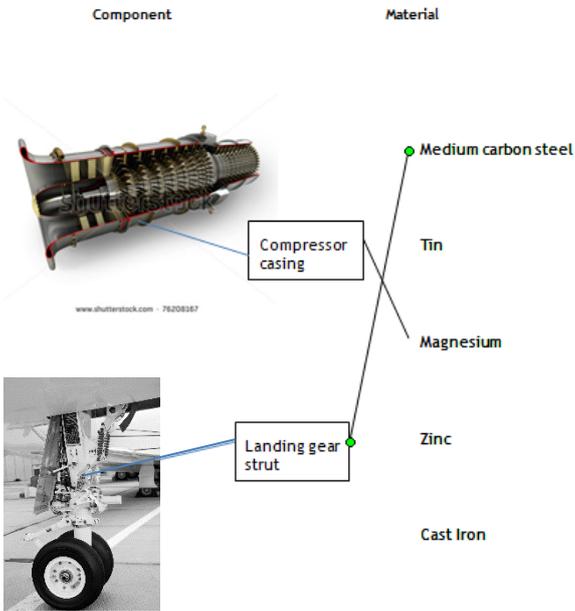
Question Number	Answer	Mark
2b	<p>Award one mark for each of the following up to a maximum of two marks:</p>  <p>The diagram shows two components on the left: a 'Satellite dish' and a 'Rotor blade'. On the right, there are five industry categories: 'Aerospace', 'Automotive', 'Marine', 'Communications', and 'Nuclear'. Lines connect the 'Satellite dish' to 'Aerospace', 'Automotive', and 'Communications'. Lines connect the 'Rotor blade' to 'Marine' and 'Nuclear'.</p>	2

Question Number	Answer	Mark
2c	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • can be fed directly into a hopper (1) • suitable for compression / injection / transfer moulding (1) • reduces processing time for moulding (1) • reduces wastage (1) • needs less energy to melt the polymer (1) <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark
3a	C – metals	1

Question Number	Answer	Mark
3b	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • chemical and durability (1) • chemical (1) • durability (1) <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark
3c	<p>Award one mark for any of the following, up to a maximum of two marks:</p> <ul style="list-style-type: none"> • yacht masts (1) • tripod legs (1) • exhaust parts for cars (1) • vehicle chassis members (1) • canopy poles (1) • drive shafts (1) • bicycle frames (1) • fuel pipes (1) • wire casings (1) • central heating pipes (1) <p>Accept any other reasonable response.</p>	2

Question Number	Answer	Mark
3d	<p>Award one mark for each of the following:</p>  <p>The diagram consists of two columns: 'Component' and 'Material'. Under 'Component', there are two images: a cutaway of a compressor casing and a landing gear strut. Under 'Material', there are five options: Medium carbon steel, Tin, Magnesium, Zinc, and Cast Iron. Lines connect the compressor casing to Medium carbon steel, Tin, and Magnesium. A line connects the landing gear strut to Zinc. A green dot is placed next to 'Medium carbon steel' and another green dot is placed next to 'Zinc'.</p>	2

Question Number	Answer	Mark
4a	<p>Only acceptable answers:</p> <ul style="list-style-type: none"> • automotive (1) • auto (1) <p>Accept phonetic spelling.</p> <p>Allow for regional variation.</p>	1

Question Number	Answer	Mark
4b	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • painting (1) • plating/electroplating (1) • galvanising (1) • anodising (1) • plastic coating (1) • surface nano-technology (1) <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark
4c	<p>Award one mark for advantage and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • A wide range of wheel sizes can be manufactured (1) as material can be cut to the required length/width (1) • Production speeds can be increased (1) as sheet form allows for stamping/faster cutting methods (1) • Different diameters of wheel can be produced (1) as sheet material can be formed to the correct curvature (1) • The wheel disc and the rim can be made from the same sheet material (1) reducing material requirements/allowing for economies of scale (1) • A wide range of shaping/forming processes can be used (1) reducing the need for secondary machining (1) <p>Accept any other appropriate advantage with expansion.</p>	2

Question Number	Answer	Mark
4d	<p>Award one mark for an advantage and one additional mark for the appropriate expansion to a maximum of two marks, up to a maximum of four marks.</p> <ul style="list-style-type: none"> • Low carbon steel can be formed easily (1) reducing the amount of energy needed for a wheel to be formed (1) • Low carbon steel can be machined easily (1) reducing the amount of tool wear/labour skills needed(1) • Low carbon steel is easily welded (1) as the low carbon content reduces the risk of cracking during manufacture (1) • Low carbon steel can be cold worked (1) reducing the time needed to form the car wheels (1) <p>Accept any other appropriate response.</p>	4

Question Number	Answer	Mark
5a	Award one mark for any of the following: <ul style="list-style-type: none"> • changes in temperature (1) • temperature (1) • heat (1) 	1

Question Number	Answer	Mark
5b	Award one mark for any of the following, up to a maximum of two marks: <ul style="list-style-type: none"> • auto choke systems in (car) engines (1) • medical implants (1) • stents (1) • self-repairing car body panels (1) • self-disassembling mobile phones (1) • heat-shrinkable tubes (1) • bike handles (1) • reusable moulds (1) • aeroplane wings (1) • mandrels (1) 	2

Question Number	Answer	Mark
5c	<p>Award one mark for a disadvantage and one additional mark for the appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • Large amounts of waste material is generated (1) which must be processed and disposed of which would cost time/money (1) • Mineral ores may only contain limited amounts of metallic materials (1) making the process expensive/less efficient than buying processed materials (1) • Quality of the metallic material could be substandard (1) leading to raw materials not being available for manufacturing smart materials (1) • The percentage of metal within the ore is often small (1) therefore large amounts of ore are needed to produce the quantities of metal needed to produce smart materials (1) • Large amounts of energy are needed to process materials (1) which may be uneconomic if only small amounts of ore are present (1) <p>Accept any other appropriate reason with expansion.</p> <p>Do not accept generic environmental responses</p>	2

Question Number	Answer	Mark
5d	<p>Award one mark for an advantage and one additional mark for the appropriate expansion to a maximum of two marks, up to a maximum of four marks.</p> <ul style="list-style-type: none"> • The oven would blend into the rest of the kitchen (1) as the panel would be the same colour as all other surfaces/doors (1) • The window will become transparent when the oven is warm (1) allowing the user to be able to see food cooking (1) • A clear window indicates the oven is warm/hot (1) improving safety within the kitchen (1) • Does not need an external power source (1) therefore can indicate high temperatures even if the oven is turned off (1) • Does not need to be in direct contact with the heat source to function (1) therefore reducing the need for maintenance (1) <p>Accept any other reasonable response.</p> <p>Do not accept 'safe/safer' without justification.</p>	4

Question Number	Answer	Mark
6ai	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • bar (1) • wire (1) • forging (1) • casting (1) • rod (1) <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark
6aai	<p>Award one mark for an advantage and one additional mark for the appropriate expansion, up to a maximum of two marks:</p> <ul style="list-style-type: none"> • To reduce brittleness (1) to reduce the likelihood of the chain snapping when in tension (1) • All links of the chain will have the same properties (1) resulting in the chain performing as specified (1) • There is less chance of the chain being damaged if it is hit by other objects (1) because tempering increases the impact resistance/toughness of the chain (1) • To reduce the effects of changes in temperature (1) when the chain is submerged in water/being used in hot and cold weather (1) <p>Accept any other reasonable response.</p>	2

Question Number	Answer	Mark
6b	<p>Award one mark for an advantage and one additional mark for the appropriate expansion to a maximum of two marks, up to a maximum of four marks.</p> <ul style="list-style-type: none"> • Additional fibre reinforcement can add strength to the mast where loadings are highest (1) because masts are subjected to high wind loading (1) • Additional fibre reinforcement increases the stiffness of the mast (1) resulting in masts that are designed to perform better (1) • Additional fibre reinforcement allows the mast to be made with teardrop profiles (1) resulting in improved aerodynamic performance (1) • Additional fibre reinforcement increases the buckling resistance of the mast (1) therefore masts are less likely to bend or twist when under load (1) • Additional fibre reinforcement increases the ability of the mast to resist compressive loading (1) because masts are subjected to high axial loads (1) <p>Do not accept 'stronger'/'tougher' without justification</p> <p>Accept any other reasonable response.</p>	4

Question Number	Indicative content	Mark
7	<p>General considerations</p> <ul style="list-style-type: none"> • Smartphones need to be dismantled before any recovery/recycling can take place • Use of recyclable materials reduces the environmental impact of disposal of the smartphone • Materials will need to be separated after disposal if they are to have further use • A large proportion of the materials can be recycled • If disposed of in landfill, polymers do not biodegrade • Some metals can be recovered and recycled for other products • Polymers need to be separated into thermoplastics and thermosets • Non-ferrous metals from batteries can be extracted and recovered • Polymer casings can be ground down for further use in mouldings • Materials should be clearly marked for recycling purposes • Reduces the overall environmental impact of the phone if materials are able to be recovered or recycled • Incorrect disposal methods can contaminate land/water • Some non-ferrous metals (lead) are hazardous to people/animals • Some materials cannot be separated, including those used in circuit boards • Joining methods could prevent materials from being recycled • Customers/consumers may not be aware of how to dispose of the phone safely 	8

	<p>Model answer</p> <p>Using a range of materials in smartphones can cause problems when the customer wants to dispose of the phone. They might not know how to dispose of the phone safely and throw it away with the general waste. This could then go to landfill and some of the metals in the phone could cause the land and water to become polluted. This is possible from batteries that contain lead and other toxic metals. It would be better if the phone could be recycled. To do this, the manufacturer would need to identify each of the materials used. These then need to be separated before they can be recycled. There is an environmental benefit in doing this, as aluminium and thermoplastics can be recycled and used in other products, reducing the need for more raw materials. Care needs to be taken during disposal to make sure those materials that can be recycled are separated, and those that cannot are disposed of safely.</p>	
Level	Descriptor	
0 0 marks	No rewardable material	
1 1-3 marks	A few key points identified, or one point described in some detail. The answer is likely to be in the form of a list. Only one viewpoint considered. Points made will be superficial/generic and not applied/directly linked to the situation in the question. The learner has a limited understanding of the implications of smartphones containing a range of materials.	
2 4-6 marks	Some points identified, or a few key points described. Consideration of more than one viewpoint but there will be more emphasis on one of them. The answer is unbalanced. Most points made will be relevant to the situation in the question, but the link will not always be clear. The learner has a good understanding of the implications of smartphones containing a range of materials.	
3 7-8 marks	Range of points described, or a few key points explained in depth. All sides of the case are considered and the answer is well-balanced, giving weight to all viewpoints. The majority of points made will be relevant and there will be a clear link to the situation in the question. The learner has a developed understanding of the implications of smartphones containing a range of materials.	

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Welsh Assembly Government

