



Mark Scheme (Results)

Summer 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 Template
Engineering Unit38 1606 1st Draft

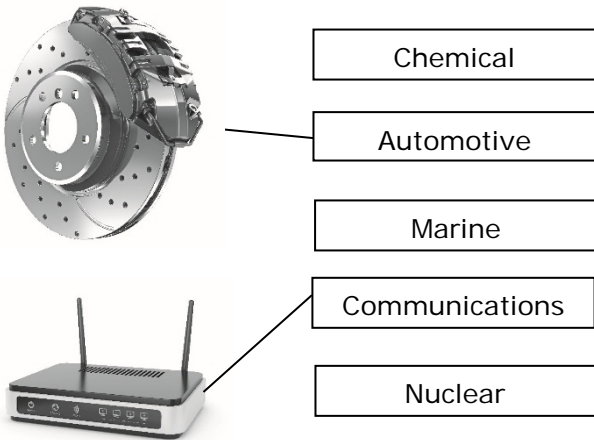
Question Number	Answer	Mark
1a	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • stainless steel (1) • duralumin (1) • brass (1) • bronze(1) • solder (1) • shape memory (1) <p>Accept any other reasonable response</p>	1

Question Number	Answer	Mark
1b	C – Magneto-rheostatic fluid	1

Question Number	Answer	Mark
1c	<p>Award one mark for any of the following up to a maximum of two marks:</p> <ul style="list-style-type: none"> • opacity (1) • thermal conductivity (1) • mass (1) • density (1) • melting point (1) • electrical conductivity (1) • magnetic (1) • translucence (1) • transparency (1) <p>Accept any other reasonable response</p>	2

Question Number	Answer	Mark
1d	D – Kevlar	1

Question Number	Answer	Mark
1e	Award one mark for any of the following: <ul style="list-style-type: none"> • brittleness • brittle Accept any other reasonable response	1

Question Number	Answer	Mark
2a	Award one mark for each of the following up to a maximum of 2 marks: 	2

Question Number	Answer	Mark
2b	A - particulate C – laminar	2

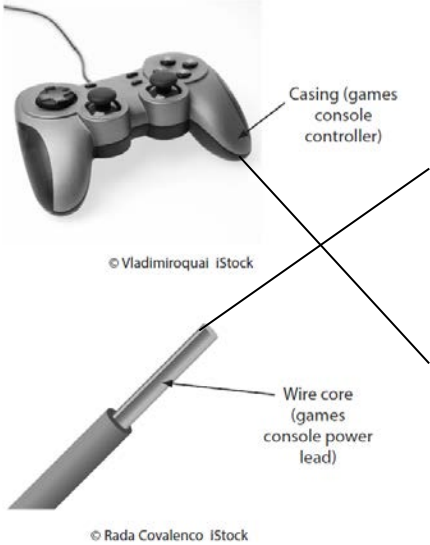
Question Number	Answer	Mark
2c	Award one mark for each of the following up to a maximum of 2 marks: <ul style="list-style-type: none"> • stronger than other forms of supply [such as a casting] (1) • shape/profile is complete/near complete (1) • limited additional machining required (1) • properties of forged metal are consistent (1) • good fatigue resistance (1) • good ductility (1) • forgings have uniform grain flow (1) • grain flow can be controlled to meet performance requirements (1) Accept any other reasonable response	2

Question Number	Answer	Mark
2d	<p>Award one mark for any of the following</p> <ul style="list-style-type: none"> • Processing (1) • Refining (1) • Processing of raw materials and products (1) <p>Accept any other reasonable response</p>	1

Question Number	Answer	Mark
3a	C - tempering	1

Question Number	Answer	Mark
3b	<p>Award one mark for any of the following, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • Corrosion resistance (1) • Solvent resistance (1) • Resistance to environmental degradation (1) • Wear resistance (1) <p>Accept any other reasonable response</p>	2

Question Number	Answer	Mark
4a	<p>Only acceptable answers:</p> <ul style="list-style-type: none"> • Electrical (1) • Electronics (1) • Electronic (1) • Electrical/electronic (1) • Electronic/Electrical (1) <p>Accept phonetic spelling</p>	1

Question Number	Answer	Mark
4b	<p>Award one mark for each of the following:</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Component</p>  </div> <div style="text-align: center;"> <p>Material</p> <div style="display: flex; flex-direction: column; gap: 10px;"> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; width: 80px; text-align: center;">Graphene</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; width: 80px; text-align: center;">Copper</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; width: 80px; text-align: center;">Bauxite</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; width: 80px; text-align: center;">HDPE</div> <div style="border: 1px solid gray; border-radius: 10px; padding: 5px; width: 80px; text-align: center;">Bakelite</div> </div> </div> </div>	2

Question Number	Answer	Mark
4c	<p>Award one mark for identification and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • Components can be recovered (1) reducing the need to produce more (1) • Lowers the carbon footprint of the product (1) as less material is disposed of/mined/extracted (1) • reduction of cost associated with processing raw materials (1) as recycling materials is requires less processing and energy use (1) • Enhanced company reputation as seen to be green (1) which could increase market share (1) <p style="text-align: right;">(1x2)</p> <p>Accept any other appropriate reason with expansion.</p>	2

Question Number	Answer	Mark
5a	<p>Award one mark for any thermoplastic response and one mark for any thermoset response, up to a maximum of two marks:</p> <ul style="list-style-type: none"> • Thermoplastic can be heated and reformed many times (1) whereas thermosets can only be heated and moulded once (1) • Thermoplastics can be recycled (1) but thermosets are not normally recyclable (1) • Polymers cross link in thermosets (1) whereas they do not in thermoplastics (1) • Thermoset materials undergo a chemical reaction on curing (1) but thermoplastics do not and only solidify (1) <p>Both thermosets and thermoplastics must be considered for both marks</p>	2

Question Number	Answer	Mark
5b	<p>Award one mark for a reason and one additional mark for the appropriate expansion to a maximum of two marks per response, up to a maximum of four marks.</p> <ul style="list-style-type: none"> • Plastic coatings have better resistance to solvents than paints (1) which will prevent the washing machine from becoming damaged over time (1) • Plastic coatings provide a better corrosion resistant layer to the washing machine (1) compared to paints which often have gaps in the paintwork /are not completely waterproof (1) • Plastic coatings do not need to have a long drying time (1) improving production rates (1) • The process is more efficient than painting (1) because only one coat will need to be applied (1) • Plastic coatings are more durable than painted finished (1) meaning the washing machine is less likely to be damaged when in a kitchen (1) • Plastic coatings will be more even than with paint (1) ensuring a higher quality end product (1) • Plastic coatings adds a hard outer coating to the washing machine (1) which is less likely to be damaged/scratched/chipped when in frequent use (1) <p style="text-align: right;">(2x2)</p> <p>Accept any other appropriate reason with expansion.</p>	4

Question Number	Answer	Mark
6a	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • Tube (1) • Pipe (1) • Hollow round section (1) • Hollow tube (1) • Tubing (1) • Piping (1) <p>Accept any other reasonable response</p>	1

Question Number	Answer	Mark
6b	<p>Award one mark for any of the following, up to a maximum of two marks:</p> <ul style="list-style-type: none"> • Stable over a wide temperature range (1) • Has a good surface finish (1) • Enables a consistent paint finish (1) • Can have pigments added/ allows for a range of colours to be produced (1) • Can be injection moulded (1) • Allows the bumper to be manufactured as one part (1) • Can be easily recycled (1) • Excess materials are not wasted (1) • Lightweight material (1) <p>Accept any other reasonable response</p>	2

Question Number	Answer	Mark
6c	<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"> • Allows the amount of light passing through the roof to be controlled (1) from almost clear to virtually opaque/to increase privacy of occupants (1) • Can control the amount of UV light passing through (1) reducing the risks to passengers (1) • Able to control the temperature inside the car (1) reducing the need to use air conditioning (1) • Reduces glare for passengers (1) allowing a more comfortable journey (1) • Has sound proofing qualities (1) reducing the impact from traffic noise on passengers (1) • Can be remotely adjusted by the occupants (1) allowing for safe adjustment/avoid the need for blinds (1) <p>Accept any other reasonable response</p>	4

Question Number	Answer	Mark
7a	<p>Award one mark for a reason and one additional mark for the appropriate expansion to a maximum of two marks, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • To increase hardness (1) to increase resistance to damage/wear (1) • To prevent contact with the air (1) which then prevents corrosion (1) • To create a barrier to the environment (1) preventing degradation/ extend service life (1) • To improve the surface finish (1) which allows it to be aesthetically pleasing/easier to clean (1) <p>Accept any other reasonable response</p>	2

Question Number	Answer	Mark
7b	<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"> • Cast iron has good wear resistance (1) so piston rings will last a long time (1) • Cast iron has low-friction properties (1) as it has self-lubricating properties(1) • Cast iron remains stable at high temperatures (1) so piston rings will not deform in use (1) • High speed engine operation does not affect the rings (1) ensuring consistent pressure against the bore (1) <p>Accept any other reasonable response</p>	4

Question Number	Answer	Mark
7c	<p>Award one mark for an advantage and one additional mark for the appropriate expansion</p> <ul style="list-style-type: none"> • The fibre reinforcement improves rigidity (1) that stops the hose from cracking (1) • The fibre reinforcement adds strength (1) to withstand high pressures (1) • The fibre reinforcement improves the stability of the hose (1) allowing application in a range of different temperatures (1) • The fibre reinforcement improves abrasion resistance (1) allowing the hose to last for longer (1) <p>Accept any other reasonable response</p>	2

Question Number	Indicative content	Mark
8	<p>General considerations:</p> <ul style="list-style-type: none"> • Materials chosen need to be capable of withstanding the forces they are exposed to when turning in water • Polymers need to be able to operate in hostile environments/salt water as exposure to salt water may affect the properties of the propeller • Blade geometry may be different to aluminium propellers • Lifespan of the polymer may be different to aluminium <p>Possible positive factors for using polymers</p> <ul style="list-style-type: none"> • The polymer should be capable of being injection moulded • Polymers could allow the propeller blades to be made more economically • Complex curved blades can be made in one piece • Allows an optimized profile for the propeller blade • Reduces the cost of propellers which could improve market share • Allows the weight of the boat to be reduced • Allows for the use of lower cost additive manufacturing <p>Possible negative factors for using polymers</p> <ul style="list-style-type: none"> • Customers may not have confidence in the strength/suitability of the material • Some polymers could be easily damaged by debris in the water • Extensive testing will be needed to ensure propellers function correctly • Propeller sizes may need to be different, meaning they may not be interchangeable with aluminium propellers • Polymer propellers may not be as durable as aluminium <p>Model answer</p> <p>Using polymers for the propeller would reduce the weight of the engine and therefore the boat. This would allow the engine to be more efficient. Different blade profiles may be developed which are more effective, but these would need to be tested and may need to be larger in order to provide the same amount of thrust. This means they may not fit on all boats. The propeller could be made using additive manufacturing methods, which reduces the costs of manufacture and can</p>	8

	allow for complex geometries of blade. The company would need to test each of the shapes however to make sure they work efficiently which could be costly.	
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 suitability of polymer material for marine propellers	
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 suitability of polymer material for marine propellers	
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 suitability of polymer material for marine propellers	

