Mark Scheme (Results)

June 2019

BTEC Level 1/Level 2 Firsts in Engineering

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

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Question Number	Answer	Mark
1a	Award **one** mark for any of the following: • Stainless steel (1) • Steel (1) • Duralumin (1) • Bronze (1) • Brass (1) • Solder (1) • Pewter (1) Accept any other reasonable response	1

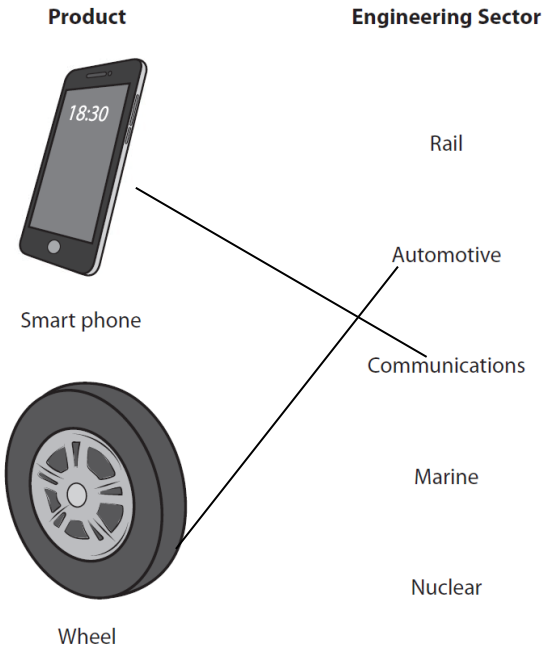
Question Number	Answer	Mark
1b	B- Compressive strength D - toughness	2

Question Number	Answer	Mark
1c	Award **one** mark for any of the following up to a maximum of 2 marks: • Mass (1) • Density (1) • Melting point (1) • Thermal Conductivity (1) • Electrical Conductivity (1) • Magnetic (1) • Opacity (1) • Translucency (1) • Transparency (1) Accept any other reasonable response	2

Question Number	Answer	Mark
1d	A - anodising D - plating	2

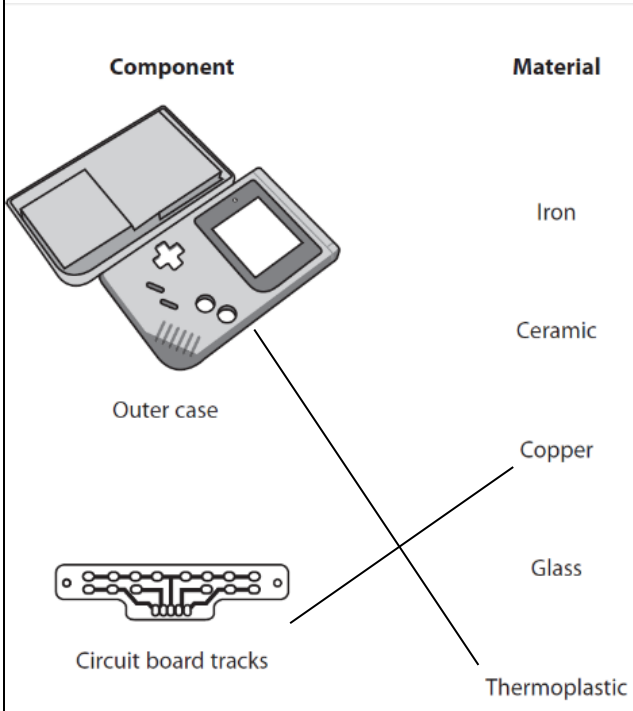
Question Number	Answer	Mark
1e	Award **one** mark for the following: • The ability of a material not to be damaged in normal use (1) • The ability of a material to resist the removal and deformation of material from its surface as a result of mechanical action (1) • The hardness of the material (1) Accept any other reasonable response	1

Question Number	Answer	Mark
2a	A - biodegradation	1

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

Question Number	Answer	Mark
2c	Award **one** mark for any of the following • Reduce internal stresses (1) • Improves structure of the steel (1) • Improves ability to cold work (1) • Improves workability (1) • Improves machinability (1) • Restores ductility (1) Accept any other reasonable response	1

Question Number	Answer	Mark
3a	C - metals	1

Question Number	Answer	Mark
3b	Award **one** mark for each of the following up to a maximum of 2 marks:  	2

Question Number	Answer	Mark
3c	Award **one** mark for any of the following, up to a maximum of two marks. • Bar stock (1) • Sheet materials (1) • Pipe/tube (1) • Plate (1) • Forgings (1) • Extrusions (1) • Wire (1) • Powders (1) Accept any other reasonable response	2

Question Number	Answer	Mark
4a	Award **one** mark for any of the following: • Does not rust/corrosion resistant (1) • Able to be cast (1) • Relatively light in weight (1) • Easy to form (1) Accept any other reasonable response	1

Question Number	Answer	Mark
4b	Award **one** mark for an advantage, up to a maximum of **two** marks • Stable over a wide temperature range (1) • Has a good surface finish (1) • Allows for a range of colours to be produced (1) • Can be injection moulded (1) • Allows the engine cover to be manufactured as one part (1) • Good thermal insulators (1) • Relatively easy to form into large covers (1) • Lightweight/low mass (1) Accept any other appropriate advantage	2

Question Number	Answer	Mark
4c	Award **one** mark for an advantage and **one** additional mark for appropriate expansion, up to a maximum of **two** marks. • Oil needs to be drilled for/extracted from the ground (1) which produces large amounts of pollution (1) • Production requires large amounts of energy (1) which can increase demands for fossil fuels (1) • Processing of oil is an expensive process (1) due to the complex nature of refining /separating (1) Accept any other appropriate advantage	2
Question Number	**Answer**	**Mark**
4d	Award **one** mark for advantage and **one** additional mark for appropriate expansion, up to a maximum of **four** marks. • Plastic coatings provide a better corrosion resistant layer to the boat hull (1) compared to alternatives which often have gaps in the paintwork /are not completely waterproof (1) • Plastic coatings have a short curing/drying time (1) improving production rates (1) • The process is more efficient than alternatives (1) because only one coat will need to be applied (1) • Plastic coatings are more durable than painted finishes (1) meaning the boat is less likely to be damaged when in normal use (1) • Plastic coatings have a smooth surface finish (1) meaning lower friction in the water (1) • The thickness of the coating can be varied (1) allowing for different customer requirements (1) Accept any other appropriate reason with expansion.	4

Question Number	Answer	Mark
5a	Only acceptable answers: • Electrical (1) • Electronics (1) • Electronic (1) • Electrical/Electronic (1) • Electronic/Electrical (1) Accept any other reasonable response Accept phonetic spelling	1

Question Number	Answer	Mark
5b	Award **one** mark for any of the following, up to a maximum of two marks. • Good welding properties (1) • High strength (1) • Good impact resistance (1) • Has good machining properties (1) • Long lasting/durable (1) • Can be supplied in large sheets (1) • Takes surface finishes well (1) • Good malleability (1) Accept any other reasonable response	2

Question Number	Answer	Mark
5c	Award **one** mark for advantage and **one** additional mark for appropriate expansion, up to a maximum of **four** marks. • Quantum tunnelling composite screens only uses a very small current (1) therefore will not add to the running cost of the machine (1) • Screens respond to the level of pressure applied (1) allowing for fewer buttons to be needed (1) • The touch screens can be made in a range of shapes (1) allowing the control panel to fit around other features of the washing machine (1) • Allows screens to be curved rather than flat (1) therefore they can be blended into curved edges of the machine (1) • The touch screen would have fewer moving parts (1) which would make them more reliable (1) • The QTC is temperature resistant (1) so the heat from the washing machine will not damage it (1) • Only small quantities of QTC required to generate current (1) so potential to reduce screen size/smaller panel (1) Accept any other appropriate reason with expansion.	4

Question Number	Answer	Mark
6a	Award **one** mark for any of the following: • Piezoelectric materials require minimal power to operate (1) • Piezoelectric materials are light in weight (1) • Piezoelectric materials can quickly return to their original shape/form (1) • Piezoelectric materials can produce an electrical charge when stretched (1) • Piezoelectric materials reduce vibration (1) Accept any other reasonable response	1

Question Number	Answer	Mark
6b	Award **one** mark for reason and **one** additional mark for appropriate expansion, up to a maximum of **four** marks. • Resin can be poured directly in to a mould (1) allowing intricate rotor blade shapes to be formed (1) • Resin can fully encase other materials (1) improving the structural integrity of the rotor blades (1) • Resins can reduce the processing time for moulding (1) as they can be formed at room temperature (1) • Resins can be used with reinforcement fibres (1) to produce composite blades (1) • Can be supplied by tanker (1) therefore the liquid is easy to load/unload on delivery (1) • No material wastage (1) as any excess can be reused (1) Accept any other reasonable response	4

Question Number	Answer	Mark
6c	Award **one** mark for advantage and **one** additional mark for appropriate expansion, up to a maximum of **four** marks. • Magnesium castings are more durable than those made from other metals (1) so they will be less affected by vibration in the helicopter (1) • Magnesium is much lighter/lower mass than alternative materials (1) reducing the weight of the helicopter/improved fuel efficiency (1) • Magnesium dissipates heat well (1) reducing the risk of engine failure (1) • Magnesium has low energy requirements during manufacture (1) meaning production costs are lower (1) • Magnesium has good machining properties (1) as it naturally lubricates/lower cutting resistance (1) • Magnesium has good corrosion resistance properties (1) meaning it is less likely to degrade during its service life (1) Accept any other reasonable response	4

Question Number	Indicative content	Mark
6d	Possible advantages of composites • Composites are resistant to weathering/corrosion/does not need to be painted • Parts can be designed and made to be lightweight/low mass • Complex/aerodynamic shapes can be formed more easily • Composites can be significantly lighter than metals • The thickness of the wing parts can be varied in specific areas to make them stronger where they are attached to the main part of the wing • Additional strengthening can be included where it is needed • Complex mouldings can be created at relatively low costs	8

	Possible disadvantages of composites • Relatively expensive material cost in comparison to metals • Difficult to automate • Hard to make repairs to damaged parts • Requires a large amount of energy if cured in an autoclave • Composites are difficult to recycle • Risk of delamination if damaged Model answer Using composites for the aeroplane wing parts has the advantage it will not add much weight to the wing and could make it more fuel efficient than if they were made from aluminium. This means that the plane could fly higher or further. However, the processes involved in the production of wing parts could use a lot of energy. This increases the energy costs, although the manufacturing costs are lower than for wing parts made from metal. It is possible to strengthen specific areas of the parts where they might need to be connected to the wing, or they can be made in intricate shapes.	

Level	**Descriptor**
0 0 marks	No rewardable content
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 use of composites for parts of aeroplane wings
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 use of composites for parts of aeroplane wings
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 use of composites for parts of aeroplane wings

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Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE