

Mark Scheme Summer 2008

GCE

GCE Engineering (8731/9731)

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6931/01 Mark Scheme

Question Number	Answer	Mark															
1	<p>Allow 1 mark for each correct box</p> <table border="1"> <thead> <tr> <th>Hazards</th> <th>Risk</th> <th>Precaution/Control Measure</th> </tr> </thead> <tbody> <tr> <td>spot welding</td> <td> <ul style="list-style-type: none"> Sparks into eyes cuts electric shock burns </td> <td> <ul style="list-style-type: none"> Goggles/face shield wear gloves ensure welder is insulation tested </td> </tr> <tr> <td>use of epoxy adhesives</td> <td> <ul style="list-style-type: none"> Skin irritations fumes </td> <td> <ul style="list-style-type: none"> Wear gloves/protect hands ventilation </td> </tr> <tr> <td>soldering</td> <td> <ul style="list-style-type: none"> Fumes into lungs skin burns </td> <td> <ul style="list-style-type: none"> Fume extraction Place iron in stand when not in use </td> </tr> <tr> <td>milling</td> <td> <ul style="list-style-type: none"> Small pieces of swarf flying off workpiece flying off tool coming off </td> <td> <ul style="list-style-type: none"> Guard and/or goggles clamp workpiece clamp tool </td> </tr> </tbody> </table> <p><i>Allow suitable alternative answers</i></p> <p style="text-align: right;">(8 x 1)</p>	Hazards	Risk	Precaution/Control Measure	spot welding	<ul style="list-style-type: none"> Sparks into eyes cuts electric shock burns 	<ul style="list-style-type: none"> Goggles/face shield wear gloves ensure welder is insulation tested 	use of epoxy adhesives	<ul style="list-style-type: none"> Skin irritations fumes 	<ul style="list-style-type: none"> Wear gloves/protect hands ventilation 	soldering	<ul style="list-style-type: none"> Fumes into lungs skin burns 	<ul style="list-style-type: none"> Fume extraction Place iron in stand when not in use 	milling	<ul style="list-style-type: none"> Small pieces of swarf flying off workpiece flying off tool coming off 	<ul style="list-style-type: none"> Guard and/or goggles clamp workpiece clamp tool 	(8)
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Total for question		8															

If specific material is incorrect, 1 mark can be allowed for an appropriate property of the material.

Question Number	Answer	Mark
3(a)(i)	<p>Galvanising</p> <ul style="list-style-type: none"> The steel (1) should be chemically cleaned (1) (allow pickling) in a caustic solution (1) first. Steel is then dipped into molten zinc (1). <p>Any 3 points</p> <p style="text-align: right;">(3 x 1)</p>	(3)
3(a)(ii)	<p>Electroplating</p> <ul style="list-style-type: none"> The metal (1) should be chemically cleaned (1). The metal is put into a chemical bath (1) containing salts of the metal to be deposited. A dc (1) electric current is passed (1) through the bath, with the object to be coated as an (1) electrode. <p>Any 3 points</p> <p style="text-align: right;">(3 x 1)</p>	(3)
3(b)	<p>Reason</p> <ul style="list-style-type: none"> To prevent corrosion/rusting/oxidation of the metal Aesthetic reasons <p>Any 1 point</p>	(1)
Total for question		7

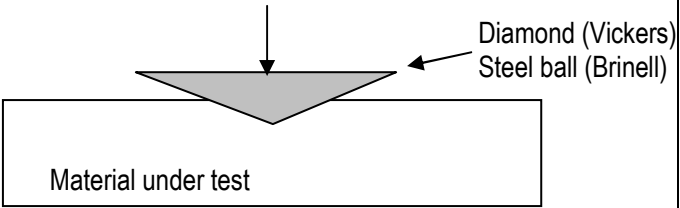
Question Number	Answer	Mark
4(a)(i)	<ul style="list-style-type: none"> • Any steel (1) • Stainless Steel (1) • Carbon Fibre (1) <p style="text-align: right;">(1 x 1)</p>	(1)
4(a)(ii)	<ul style="list-style-type: none"> • Resist Oxidisation (1) • High tensile strength (1) (not “strong”) • Inexpensive (1) • Aesthetic (1) <p style="text-align: right;">(2 x 1)</p>	(2)
4(b)(i)	<ul style="list-style-type: none"> • Perspex (1) • Glass (1) • Acrylic (1) • Polycarbonate (1) <p style="text-align: right;">(2 x 1)</p>	(2)
4(b)(ii)	<ul style="list-style-type: none"> • Glass has disadvantage of being brittle (1) but advantage of being scratch proof (1) • Acrylic has advantage of being easier to manufacture (1) and of being a lower cost (1) <p><i>If part (b)(i) is incorrect, but the follow through in (b)(ii) is appropriate for the learner’s materials, marks must be allowed for part (b)(ii).</i></p> <p style="text-align: right;">(4 x 1)</p>	(4)
Total for question		9

Question Number	Answer	Mark
5(a)(i)	<p>Material</p> <ul style="list-style-type: none"> • Low carbon steel (1) OR • Aluminium alloy <p>Reason</p> <ul style="list-style-type: none"> • Low carbon steel - high tensile strength (1), low cost (1). • Aluminium alloy - high tensile strength (1), light weight (1) and is corrosion resistant (1). <p style="text-align: right;">(3 x 1)</p>	(3)
5(a)(ii)	<p>Material</p> <ul style="list-style-type: none"> • Copper (1) <p>Reason</p> <ul style="list-style-type: none"> • Lowest electrical resistivity and flexible for wiring (2). <p style="text-align: right;">(3 x 1)</p>	(3)
5(a)(iii)	<p>Material</p> <ul style="list-style-type: none"> • Aluminium alloy (1) <p>Reason</p> <ul style="list-style-type: none"> • Lowest density, but has suitably high tensile strength (2). <p style="text-align: right;">(3 x 1)</p>	(3)
5(a)(iv)	<p>Material</p> <ul style="list-style-type: none"> • Low carbon steel (1) <p>Reason</p> <ul style="list-style-type: none"> • Lowest relative cost (1), easily formed (1) <p style="text-align: right;">(3 x 1)</p>	(3)
5(b)(i)	<ul style="list-style-type: none"> • Aluminium alloy 	(1)
5(b)(ii)	<ul style="list-style-type: none"> • Molten metal (1) is poured into the die under gravity (1). The die is usually made of steel (1). After cooling the die is split if needed (1) and the part removed. Removal of any excess (1). Allow to cool (1) <p style="text-align: right;">(4 x 1)</p>	(4)

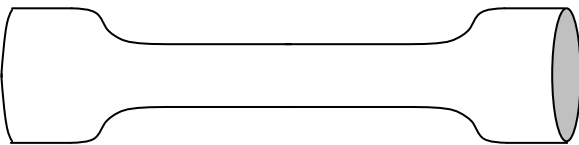
5(c)	<ul style="list-style-type: none"> • Stainless steel will not rust or corrode (1), so will not need to be replaced frequently (1) • Stainless steel is self- finishing (1), saving costs of coating (1) • Stainless steel is aesthetically pleasing, adding to the appeal of the motorcycle (1). • Stainless steel has high tensile strength(1), corrosion resistant (1). <p style="text-align: right;">(4 x 1)</p>	(4)
Total for question		21

Question Number	Answer	Mark
6(a)	<ul style="list-style-type: none"> • A mould (1) of the surface is needed, and a release agent (1) is coated onto the mould. Onto this layers of carbon fibre (1) are laid, interspersed with resin (1). The direction can be changed, to give strength in all directions 1) of the surface. The composite is then cured (1) and finally removed from the mould (1). For safety, goggles (1) should be used and the area should be ventilated well (1). A colour pigment may also be used (1) <p><i>Any 5 suitable points</i></p> <p style="text-align: right;">(5 x 1)</p>	(5)
6(b)	<ul style="list-style-type: none"> • High tensile or compressive strength • Resistance to corrosion • Light weight <p style="text-align: right;">(1 x 1)</p>	(1)
Total for question		6

Question Number	Answer	Mark
7(a)	<ul style="list-style-type: none"> • The wire is stripped of its insulation (1), and then soldered (1) onto the terminal. Both terminal and wire must be cleaned or tinned first if necessary (1). • The wire may need stripping (depends on type of crimp) (1) and then it is mechanically crimped (1) to a connector, and finally pushed onto the terminal (1). • A screw or terminal block method (1), where the wire is stripped (1), then captured under a screw (1) <p><i>Maximum 4 marks</i></p> <p style="text-align: right;">(4 x 1)</p>	(4)
7(b)	<ul style="list-style-type: none"> • Soldering gives a good connection (1), but it is permanent normally (1), fume extractor needed (1), and requires more skill. (1) • A crimped terminal can be disassembled (1) easily. Crimping gives a good connection quickly (1), but needs an extra connector (1). • Crimping is the best method for mass production (1), combining speed of assembly and disassembly (1), lower cost (1) • The screw method is more labour intensive (1), more costly (1), bulkier (1) but easy to disassemble (1) <p><i>Allow any 6 suitable points</i></p> <p style="text-align: right;">(6 x 1)</p>	(6)
Total for question		10

Question Number	Answer	Mark
8(a)(i)	<ul style="list-style-type: none"> • Vicker's test (1) • Brinell test (1) • Rockwell (1) <p style="text-align: right;">(1 x 1)</p>	(1)
8(a)(ii)	 <ul style="list-style-type: none"> • Indenter (diamond or steel ball) (1) • Force shown (1) • Material (1) <p style="text-align: right;">(3 x 1)</p>	(3)
8(a)(iii)	<p>Brinell:</p> <ul style="list-style-type: none"> • A hardened (1) steel ball (1) is used to indent the surface (1). A force F, (1) from 1 to 100 kgf (1) is used, and the area, A (1) of indent is measured, in square mm (1). <p>Vicker's:</p> <ul style="list-style-type: none"> • A diamond indenter (1) is used, with a pyramid (1) shape of 136 degrees (1) • The hardness is then given by $HV = F/A$ (1) or from a look-up table, using diameter of indentation (1) <p style="text-align: right;">(4 x 1)</p>	(4)
8(b)	<ul style="list-style-type: none"> • A suitable unit or scale, e.g. N/m² or BHN (Brinell Hardness number) or Rockwell scale, HB (1) 	(1)
Total for question		9

Note: Up to 3 marks may be allowed for a good description of scratch test.

Question Number	Answer	Mark
9(a)(i)	<ul style="list-style-type: none"> •  <p>Any 2 points from:</p> <ul style="list-style-type: none"> • Showing the centre uniform section (or mention of gage length) (1) (Not a tube) • Showing larger end pieces (1) • Showing a taper or radius between centre and ends. <p style="text-align: right;">(2 x 1)</p>	(2)
9(a)(ii)	<p>Stress</p> <ul style="list-style-type: none"> • $\frac{\textit{Force}}{\textit{Cross-sectional area}}$ (2) <p>Strain</p> <ul style="list-style-type: none"> • $\frac{\textit{elongation}}{\textit{original length}}$ (2) 	(4)
9(b)(i)	<ul style="list-style-type: none"> • Material B 	(1)
9(b)(ii)	<ul style="list-style-type: none"> • It has a larger extension than A (1) with no increase in stress (or load) (1) <p style="text-align: right;">(2 x 1)</p>	(2)
9(b)(iii)	<ul style="list-style-type: none"> • Material A is stiffer 	(1)
9(b)(iv)	<ul style="list-style-type: none"> • It deforms much less (1) for a given stress or load (1) <p style="text-align: right;">(2 x 1)</p>	(2)
	Total for question	12
	Total for paper	90

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