

GCSE

Design and Technology: Electronics and Control Systems

Unit **A515/03**: Sustainability and technical aspects of designing and making mechanisms

General Certificate of Secondary Education

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.


Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Question		Answer	Mark	Guidance
1		C	1	
2		B	1	
3		D	1	
4		A	1	
5		C	1	
6		SMA, smart metal, memory metal, memory alloy, muscle wire, smart alloy, nitinol, smart wire	1	Not 'smart cable' – the QTC based product.
7		Any of: <ul style="list-style-type: none"> • Poison • Toxic to humans • Harmful • Reduces brain development 	1	Allow other legitimate hazards Do not allow 'can be dangerous'.
8		Reduction in transport costs brought about by not having to 'go to the meeting' by sundry transport methods.	1	
9		Crowded/dangerous/difficult overheated working environment often for minimum wage, child labour and no rights, unregulated working.	1	
10		Acrylic (pmma, perspex, plexiglass,) polystyrene, ABS, polyester.	1	Or other oil based polymers not common in schools such as polyethylene, polypropylene, PVC. Exclude natural plastics such as casein or horn. Do not allow 'polymer' or 'thermoplastics' nor 'thermosetting'.
11		False	1	
12		False	1	
13		False	1	
14		True	1	
15		True	1	

Question		Answer	Mark	Guidance
16	(a)	<p>Any of:</p> <ul style="list-style-type: none"> • Slot for player to be held in • Lead to connect to audio source/ipod/mp3 • USB power lead • Can be charged • Two removable speakers • Volume control • On/off switch • Some sort of stand/base/prop device • Can be folded • Speakers protected in transit • Aesthetics 	3	Allow any other valid response
	(b)	<p>Any of:</p> <ul style="list-style-type: none"> • Batteries not needed • No disposal issues of spent batteries • Can power and charge should it have rechargeable cells fitted • Increasing availability of standardised USB style chargers (PSU) • Means it can be used in any country • Could accept power from other sources e.g. host computer, solar or 'emergency/duration extender' power packs 	2	Allow 'reduced cost from no batteries'

Question	Answer	Mark	Guidance														
(c)	<p>Parts identified as per question</p> <table border="1"> <thead> <tr> <th>Name of Part</th> <th>Letter on Fig.2</th> </tr> </thead> <tbody> <tr> <td>Integrated Circuit (IC) audio amplifier</td> <td>A</td> </tr> <tr> <td>Loudspeaker from PC monitor</td> <td>C</td> </tr> <tr> <td>MP3 player earphone lead with broken earphones</td> <td>E</td> </tr> <tr> <td>Piece of hardboard salvaged from back of a cupboard</td> <td>F</td> </tr> <tr> <td>Speaker grill from broken PC monitor</td> <td>D</td> </tr> <tr> <td>Tropical hardwood from old school bench</td> <td>B</td> </tr> </tbody> </table>	Name of Part	Letter on Fig.2	Integrated Circuit (IC) audio amplifier	A	Loudspeaker from PC monitor	C	MP3 player earphone lead with broken earphones	E	Piece of hardboard salvaged from back of a cupboard	F	Speaker grill from broken PC monitor	D	Tropical hardwood from old school bench	B	5	The first one is given in the question (Letter A).
Name of Part	Letter on Fig.2																
Integrated Circuit (IC) audio amplifier	A																
Loudspeaker from PC monitor	C																
MP3 player earphone lead with broken earphones	E																
Piece of hardboard salvaged from back of a cupboard	F																
Speaker grill from broken PC monitor	D																
Tropical hardwood from old school bench	B																
(d)	<p>Essentially expecting something like the picture but presented in a variety of ways such as multiple 2-D views, exploded view(s), rendered 3-D view(s) or combinations.</p> <ul style="list-style-type: none"> • Use of parts from Fig. 2, 1 mark • Drawings that communicate intentions clearly, 1 mark • Annotation, 1 mark • Functional design, 1 mark 	4	<p>Example of possible design</p> 														

Question		Answer	Marks	Content	Guidance
					Levels of response
	(e)*	<p>Candidates should use examples when illustrating their points. Answers should relate to these examples rather than generic text explaining how the carbon footprint might be reduced by ‘turning lights and machines off’.</p> <p>Suggestions such as</p> <ul style="list-style-type: none"> • Re-using LEDs • Chips • Screws and fixings • Wiring <p>With explanation about the reduction in energy used in preparing the parts for manufacture and actual manufacture, transport implications.</p> <p>May be added to in light of candidate response.</p>	6	Maximum of 2 marks for short bullet point list	<p>Level 3 (5-6 marks) Thorough explanation, with examples, showing a clear understanding of how secondary recycling can contribute to a reduced carbon footprint. There may be three or more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> <p>Level 2 (3-4 marks) Adequate explanation, possibly with examples, showing a sound understanding of how secondary recycling can contribute to a reduced carbon footprint. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation</p> <p>Level 1 (1-2 marks) Basic explanation, possibly without examples, showing some understanding of how secondary recycling can contribute to a reduced carbon footprint. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or ‘list like’. Errors of grammar, punctuation and spelling may be intrusive.</p> <p>(0) response worthy of no marks</p>
		Question 16 total	20		
		Section A Total	35		

Section B

Question			Answer	Mark	Guidance										
17	(a)	(i)	<table border="1"> <thead> <tr> <th>Name of Part</th> <th>Letter on Fig. 4</th> </tr> </thead> <tbody> <tr> <td>Steel Chain Cover</td> <td>D</td> </tr> <tr> <td>Flexible coupling</td> <td>C</td> </tr> <tr> <td>Clutch</td> <td>B</td> </tr> <tr> <td>Spring</td> <td>A</td> </tr> </tbody> </table>	Name of Part	Letter on Fig. 4	Steel Chain Cover	D	Flexible coupling	C	Clutch	B	Spring	A	3	No mark for the first answer as this is given in the question paper.
			Name of Part	Letter on Fig. 4											
			Steel Chain Cover	D											
			Flexible coupling	C											
			Clutch	B											
Spring	A														
(ii)	An applied force that tends to shorten, squeeze or squash something, decreasing its volume (air), length/size (spring). Reduces a length (by pushing/compressing) storing energy/forces which push back (when released).	2	References to compressing computer data should not be credited.												
(iii)	<ul style="list-style-type: none"> Allow two shafts (in line) (to be) slightly out of alignment Allow limited movement between fixed shafts 	2	Allow references to positive drive with negligible backlash Rotary motion through a small angle (under 1 degree)												
(iv)	<p>Three points from:</p> <ul style="list-style-type: none"> to allow (slow) engagement of drive so as not to stall engine to allow disengagement of drive from the driving force to stop movement without stopping the engine/motor provide a 'weak link' in the event of a serious malfunction – clutch slips if jam occurs 	3	Check for repetitions cleverly phrased. Allow correct description of centrifugal clutch action.												

Question		Answer	Mark	Guidance
	(b)	Ductility is the ability of a material to be deformed in a plastic manner (without hardening or becoming brittle). Drawn into e.g. wire or pressed into shape, e.g. car wing	2	Deformed and plastic (or equivalent words) are the key.
	(c)	Ticks in the boxes for: (boxes 1,4, & 6) <ul style="list-style-type: none"> • Does not produce toxic fumes • Zero pollution at point of use • No flammable liquids needed 	3	
		Question 17 total	15	

Question			Answer	Mark	Guidance
18	(a)	(i)	Poly Vinyl Chloride	1	Only, but allow odd spellings, not clearly wrong words.
		(ii)	Electric shock	1	Must relate to Electricity/electric, not just 'shock'.
	(b)		<ul style="list-style-type: none"> • Long trailing lead might be trip hazard • No RCCD fitted • Not waterproof (dangerous in the wet/rain) • No on/off switch fitted • Could be overloaded/plug too much load in/fire hazard <p>Cable might get:</p> <ul style="list-style-type: none"> • Could get knotted (shorter) • Kinked (can break the wire) • Damage by tool being used 	2	Or other statements that are genuine disadvantages
	(c)		<p>Any 4 details such as:</p> <ul style="list-style-type: none"> • Drum to hold cable • Handle or winder of some sort to rotate drum • Pegs or hooks to loop cable around • RCCD/ELCB added/provided • Master on/off switch • Lockable security • Power on indication 	4	<p>Must be wall mounted or wall-mountable, i.e. details offered such as 'screw/fixing (or nail) holes'.</p> <p>Up to 4 marks allowable for specific constructional details such as materials, joints, processes.</p> <p>Not trivial answers like 'wood' – items should be named, sketched and appropriate.</p> <p>List-like answers detailing required features can score full marks</p>
	(d)		So that repeatability/accuracy can be maintained	1	Or similar description. Needs to reflect the benefit of a jig, not just quick/cheap/easy.

Question		Answer	Marks	Guidance	
				Content	Levels of response
	(e)*	Candidates should discuss, using examples, how a products lifecycle can be affected by the choice of inappropriate, or appropriate materials and processes and the related factors brought about by these decisions such as planned obsolescence, product life cycle, ease of repair and manufactures accountability.	6	Maximum of 2 marks for short bullet point list.	<p>Level 3 (5-6 marks) Thorough discussion, with examples, of how a products lifecycle can be affected by the choice of inappropriate, or appropriate materials and processes and the related factors brought about by these decisions such as planned obsolescence, product life cycle, ease of repair and manufactures accountability. There may be three or more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> <p>Level 2 (3-4 marks) Sound discussion, possibly with an example, of how a products lifecycle can be affected by the choice of inappropriate, or appropriate materials and processes and the related factors brought about by these decisions such as planned obsolescence, product life cycle, ease of repair and manufactures accountability. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation</p> <p>Level 1 (1-2 marks) Basic discussion, possibly without any example, of how a products lifecycle can be affected by the choice of inappropriate, or appropriate materials and processes and the related factors brought about by these decisions such as planned obsolescence, product life cycle, ease of repair and manufactures accountability. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive.</p> <p>(0) response worthy of no marks</p>
		Question 18 total	15		

Question			Answer	Mark	Guidance
19	(a)	(i)	Any two of: <ul style="list-style-type: none"> • To provide some mechanical advantage • which makes it easier or • more controllable/precise or • allows a greater force to be applied than otherwise possible • moves operator away from moving parts so safer 	2	
		(ii)	Any of: <ul style="list-style-type: none"> • chipboard • osb (Sterling) board • blockboard • mdf • plywood • laminboard • pineboard 	1	Or other MMB that is genuine and suitable, i.e. not pulpboard or pin-board. NOT Glass fibre/Epoxy/PCB board
		(iii)	Any of: <ul style="list-style-type: none"> • clamp/secure the work securely or • hold the work in a vice • eye protection (goggles/ face visor) • apron/protective clothing • tie hair back, no loose clothing/ties etc. • ensure drill (bit) is secured correctly • check equipment (or have it checked) for wear and tear. • Wear gloves for handling sheet metal 	3	Accept prevention of any real risk to OPERATOR but check for repetition and vagueness like 'stay safe'. Allow 'secure stand' as the picture shows it unsecured. Don't allow 'Steel toe-capped boots'. This is for schools, not heavy industry.
		(iv)	Zinc and Copper	2	Only, allow poor spelling if intention is clear.

Question		Answer	Mark	Guidance
	(b) (i)	Defined as the load divided by the effort or The ratio of output force to the input force applied to a mechanism Less effort required to give a greater force	2	Or similarly clear statements embodying the same concepts. Give marks for understanding shown.
	(ii)	Explanation relating to how friction (drag) will use some of the force put into the mechanism and that the output will be less, or that 100% efficiency is impossible to achieve in the real world due to frictional/rubbing losses	2	Cause and effect for two marks. Nothing vague like 'slips' or 'comes loose'. Credit reference to 'more gears....gives reduced efficiency'. Credit reference to 'lubrication...reducing friction/improving efficiency'.
	(iii)	<ul style="list-style-type: none"> • needs two hands to operate (unless self-locking) • slower to open/close • harder to get the same gripping force 	2	Give marks for understanding shown. Watch for 'Harder to tighten/comes loose easily' or other such same things phrased differently.
	(iv)	Casting (die or sand)	1	Allow 'machined from billet'
		Question 19 total	15	
		Paper Total	80	

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