

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 2015

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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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Annotations

Annotation	Meaning
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓	correct response
x	Incorrect response
L1	level 1 response in (*) question
L2	level 2 response in (*) question
L3	level 3 response in (*) question
BOD	Benefit of doubt
SEEN	Nothing written or drawn, NR allocated as mark
REP	Repetition either from question or from earlier part of response

Question		Answer	Mark	Guidance
1		C	1	
2		C	1	
3		D	1	
4		B	1	
5		D	1	
6		Restriction of Hazardous Substances	1	Both required for mark, allow for spelling errors
7		Any of: <ul style="list-style-type: none"> • Wind • Solar • Tidal • Geothermal • Biomass • Hydro-electric 	1	Allow other legitimate sources if they are genuinely renewable
8		May contribute to the 'greenhouse' effect, cause global warming or cause habitat/wildlife change/death.	1	Do not allow 'damage to ozone layer' or 'production of acid rain'
9		Product will degrade naturally /rot/decay/return to nature	1	'Rot down in landfill' acceptable
10		Recycle	1	Accept Primary, secondary and tertiary recycling
11		False	1	
12		False	1	
13		True	1	
14		True	1	
15		True	1	
16	(a)	Any of: <ul style="list-style-type: none"> • Winding handle • Solar panel • Tuning dial • Telescopic aerial • Volume/on/off switch • Speaker grill 	3	Allow any other valid response

Question	Answer	Mark	Guidance
(b)	Any of: <ul style="list-style-type: none"> • Means that you don't have to keep on winding • Always ready to use (if it was charged up previously) • Long product life • Reduces built-in obsolescence • Could accept power from other sources e.g. solar 	1	Answer must reference charging method
(c)	Any of: <ul style="list-style-type: none"> • Can be dismantled/taken apart of recycling of case and components. • No big investment in tools to dismantle • Minimal labour needed – 1 person could do it all • Quicker to take to pieces not changing tools • So more can be processed in any one time • Making better use of labour force • Separate parts can be sorted as required • Re-chargeable battery can be disposed of safely 	2	Quick/fast needs to be qualified for a mark Allow reference to repair
(d)	<ol style="list-style-type: none"> 1. Already given as 'Melted down and refined'. 2. Sorted then melted down and re-used 3. Ground up and used as filler 4. Removed, tested and re-used 	3	
(e)	Any of: <ul style="list-style-type: none"> • Give to charity shop • Sell at boot fair • Pass on to family or friend • Give to LDC 'good cause' • Online auction site • Freecycle 	2	Allow others that pass the item on unchanged for re-use.
(f)	Sketches and notes that embody the basic principles of grasping the product/holding it down whilst winding/rotating the handle in a rotary manner Extending aerial, place in sunlight, operating controls	3	Allow equivalent actions that would work in some way. Principle is required rather than high levels of artistic accuracy.

Question		Answer	Marks	Guidance	
				Content	Levels of response
	(g)*	<p>Candidates should identify the benefits to the end-user e.g.</p> <ul style="list-style-type: none"> • less reliance on bought in power/batteries • fuel use reduced e.g. kerosene/paraffin for lighting, diesel/petrol for generators, mains electricity • Circuitry can be optimised for low consumption • Examples given for other wind-up products • Use of radios to keep up to date with news • Use of radio for emergencies 	6	Maximum of 2 marks for short bullet point list	<p>Level 3 (5-6 marks) Thorough explanation, showing a clear understanding of how wind-up products can improve the day to day lives of people in third world countries. There will 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, showing a some understanding of how wind-up products can improve the day to day lives of people in third world countries. 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, showing limited understanding of how wind-up products can improve the day to day lives of people in third world</p>

Question			Answer	Marks	Guidance	
					Content	Levels of response
						<p>countries. 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		

Question		Answer	Marks	Guidance
		Section B		
17	(a)	Press A, Class 2, second class, Press B, Class 1, First class	2	
	(b)	Fulcrum (F) at extreme left, Load (L) in middle cup/plate Effort (E) at end(s) of handles.	3	
	(c)	Any two from: <ul style="list-style-type: none"> • Does not come loose in use • Quick, Easy or Fast to assemble • Only one tool needed • Cheaper than equivalent nut and bolt • Strong permanent fixing 	2	Quick, easy or fast all need qualifying for a mark.
	(d)	Chromium, Chrome, Nickel	1	Allow BZP but not galvanising
	(e) (i)	Polystyrene or ABS	1	
	(ii)	Injection moulding	1	
	(iii)	Acrylic	1	Or other brands of PMMA
	(f)	A variety of different solutions are possible here: <ul style="list-style-type: none"> • Crossed belt/band drive • Bevel/mitre gears • Long series of compound gears • Bevel gears • Crown wheel and pinion • Worm and worm wheel Sketches and notes need to show: <p>A mechanism that fits within the windmill A clear link between handle shaft and sails shaft Does/could the system work Correct rotational relationship shown</p>	4	Allocate marks as follows: 4x1 Ensure that: The design solution size been considered - what is proposed should really 'fit inside'. A system does actually link the two shafts. Will what is drawn actually function? (unlikely assemblages of sundry remembered bits may not deliver). Arrows showing correct rotation for mechanism drawn or description showing understanding of mechanism shown. Notes/annotation/additional sketches that enhance explanation are also eligible for credit.
Question 17 total			15	

Question			Answer	Marks	Guidance
18	(a)	(i)	V or Vee belt	1	Only
		(ii)	Q or 'Pulley Q'	1	Only
		(iii)	To store rotational energy from each power stroke of the engine, to eliminate pulsating of generator output	2	Or other statements that embody the concept of 'store' and 'energy' for both marks
		(iv)	Ticks in 'Low Maintenance', 'Can be twisted' and 'Slips if machine jams'.	3	Only
	(b)		Statement should embody the advantages of: <ul style="list-style-type: none"> • Lower maintenance • Greater efficiency (no slip) • fewer parts to supply • less danger of getting caught/entrapment • more compact solution • lighter weight of whole machine • engine can support one end of alternator 	2	List like answers can score full marks

Question			Answer	Marks	Guidance	
					Content	Levels of response
	(c)*		Candidates should identify the difficulties of separating the component parts from composite based products or parts. The main destinations are landfill or incineration but top candidates may be aware of solvent extraction and fibre re-use. There may be some discussion of the energy saved during the lifetime of the product (by the use of composites) such as in the Airbus A350XWB or the Boeing 787 Dreamliner.	6	<p>Maximum of 2 marks for short bullet point list. Interesting discussion here:</p> <p>http://www.reinforcedplastics.com/view/1426/recycling-carbon-fibre-composites/</p> <p>and here:</p> <p>http://www.reinforcedplastics.com/view/17943/composites-can-be-recycled/</p> <p>which uses time-served wind turbine blades as an example</p>	<p>Level 3 (5-6 marks) Thorough discussion, showing good knowledge of the problems posed by composite products. There will 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)</p>

Question			Answer	Marks	Guidance	
					Content	Levels of response
						<p>Sound discussion, showing adequate knowledge of the problems posed by composite products. 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, showing some knowledge of the problems posed by composite products. 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	Marks	Guidance
19	(a)	(i)	70/14 5:1	2	1 mark for correct numbers as shown, 1 mark for velocity ratio, accept 5 alone
		(ii)	60/5 =12	2	1 mark for correct numbers as shown, 1 mark for numerical answer. Allow ECF for VR only.
		(iii)	Getting self or clothing caught in gears,	1	Accept any real risk to OPERATOR.
		(iv)	Explanation that involves: Lower SPEED but higher TORQUE Greater control or accuracy	2	Or equivalent explanation involving rpm/turning force
	(b)	(i)	Grease nipple	1	Or words that show understanding of purpose, i.e. lubrication
		(ii)	Any of: To allow quick dismantling of the joint Joint may be dismantled with simple tools Quick release compared to nuts and bolts	1	Not 'quick' alone, but other 'temporary' reasons acceptable.
		(iii)	To prevent rust or corrosion	1	Allow brand identity like farm or garden machinery
	(c)	(i)	Connecting rod	1	Only
		(ii)	Rotary.....Crank(shaft)	2	Only, allow miss-spelling, 1 mark each.
		(iii)	Any of: <ul style="list-style-type: none"> • Self lubricating • filled with oil when made • retains oil for long periods of time • does not need regular lubrication • oil circulates through bush • oil held in by capillary action • can be compression moulded to suit shaft 	2	Or other technical advantages of a sintered bush
			Question 19 total	15	

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