OCR
Oxford Cambridge and RSA

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 2018

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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.

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.
L1	Level 1
L2	Level 2
L3	Level 3
SEEN	Noted but no credit given
	Tick

Question			Answer	Mark	Guidance
1			[c]	1	
2			[c]	1	
3			[b]	1	
4			[d]	1	
5			[c]	1	
6			The Earth's core, or information about the decay of radioactive minerals resulting in heat under the earth's crust. Magma.	1	Accept 'activity in rocks'. N Not 'heat'. Not 'volcano' or 'volcanic rock' – too vague.
7			Any of: • Landfill • Burning • Littering	1	Allow other legitimate answers
8			Primary	1	
9			Planned, built-in obsolescence.	1	Allow for misspelling
10			Ergonomic(s)	1	
11			False	1	
12			False	1	
13			True	1	
14			True	1	
15			False	1	
16	(a)		Any of: • Waterproof • Shock/impact resistant/durable • Transparent/see-through • De-mountable via fitting • Positive closure clip • Operating button(s) • Means of attachment • Angle adjustment	3	Any other valid alternative. Do not accept 'protective', 'hard material', Allow movable, adjustable, secure mount to helmet, aerodynamic, fit any helmet, lightweight, compact.

Question			Answer	Mark	Guidance
	(b)		Environmental benefits, any of: • No disposal of primary batteries • Toxic material not put in landfills • Reduction in single-use batteries made • Less energy used to recharge than to remanufacture • Often have a higher capacity than primary • Can be re-used 100-1000 times	**2**	Must be an environmental benefit, i.e. not cost
	(c)		Parts identified as per question: • B • A • G • F	**4**	
	(d)		A safety line of some sort, fishing line, braided cord, strong string, stainless steel braided wire, rubber band.	**1**	Accept any valid alternative. Not a 'safety suggestion' like 'don't catch if in a dangerous situation'. Must RETAIN camera, i.e. NOT impact resistant case.
	(e)		Features shown may include: • Hard outer shell for protection [1] • Soft packing for interior [1] • Holes / shapes for parts cut out [1] • Extra / desirable features [1] • Named materials / processes [1]	**4**	Any 4 marks from 5

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
	(f)*		Candidates should use examples when illustrating their points. Answers should relate to these examples rather than generic text explaining the process. Answers should relate how CAM would enable quicker prototyping with greater accuracy. Comments about saving materials are valid if reasonably qualified but a catch-all like 'quicker' or 'cheaper' are not worthy unless qualified. • CAD / CAM • computer simulation to show how parts interact • rapid prototyping of parts to make working prototype, e.g. 3-D printing. • Appropriate use of IT.	**6**	Maximum of 2 marks for short bullet point list	**Level 3 (5-6 marks)** Thorough explanation, with examples, showing a clear understanding of how using CAD/CAM can reduce development time. 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. **Level 2 (3-4 marks)** Adequate explanation, possibly with examples, showing a sound understanding of how using CAD/CAM can reduce development time. 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 **Level 1 (1-2 marks)** Basic explanation, possibly without examples, showing some understanding of how using CAD/CAM can reduce development time. 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. **(0) response worthy of no marks**

Section B					
Question			**Answer**	**Mark**	**Guidance**
17	**(a)**	**(i)**	An arrow or circle/line pointing to the top right of Fig.3	**1**	Round unit with wires
		(ii)	Two from: • Rotation proportional to number of input pulses • Precise positioning • Known rotation per step or known distance travelled • Good at starting/stopping • Wide speed range • Simple control circuitry • Higher torque 2 x 1 marks	**2**	Must relate to the STEPPER MOTOR not anything to do with ink-jet over laser for instance.
	(b)	**(i)**	Arrow pointing to the toothed belt (either part)	**1**	
		(ii)	Up to 3 marks: • Precise registration • High torque • Slip-proof engagement • Wide speed range • No lubrication needed • Efficient (low friction) • Low noise	**3**	Maximum 2 marks for **one** a well justified advantage.
		(iii)	Up to 2 marks: • Resistant to wear (long lasting) • Rigid to maintain accuracy • Can be ground to precision sizes • Single shaft saves materials yet ensures accuracy	**2**	Strong & Durable 1 mark
		(iv)	One mark from: • Material will allow forming without fracture • May be deformed • Is plastic to a degree • Ability of a material to be deformed in a plastic manner . (without hardening or becoming brittle)	**1**	

Question			Answer	Mark	Guidance
		(v)	Zinc (plating or passivation)	1	Allow galvanised, nickel or chrome, BZP
	(c)		Any one of: • Nylon • PTFE • Polypropylene • Polythene	1	
	(d)		Ticks in boxes: 1 (Compound gear train) 2 (Increases torque) and 5 (Can reduce speed)	3	
18	(a)		**Polystyrene sheet:** • Glossy on one or both sides, softens at around 100 C • Ideal for vacuum forming (injection moulding) • School project 'shells', display stands **Acrylic sheet:** • Glossy/shiny and glass-like (brittle) • Laser cutting or line (strip) bending • Shop signs, boxes, name plates **ABS Pellets:** • Glossy and scuff-resistant • Injection moulding, vacuum forming, 3-D printing • 'Hoover' parts such as might be seen in a manufacturer sample box	9	No repetition of process unless qualified by a suitable example. Allow injection moulding ONLY if 'plastic model kits' (or wtte) mentioned May be added to in light of candidate response Accept a variety of pupil project suggestions for acrylic Allow vacuum forming if 'Hard-shell brief/suitcases' mentioned Or any product where high gloss and/or scuff resistance might be required. Only allow vacuum forming if pellets are made into sheets then….etc.
	(b)	(i)	Wood chips, sawdust, soft/hard wood waste	1	
		(ii)	Can be produced in large sheets	1	Any other valid response

Question			Answer	Mark	Guidance
	(c)		Any 4 details such as: • **Man-made** material named (plywood, MDF) • Suitability for carrying the tools e.g. ○ some indication of separate tool storage ○ consideration of shape/size of tools shown in Fig. 6. ○ Handle • Security e.g. ○ lid/top/mechanism to prevent tools falling out when being carried.	**4**	Must be suitable for carrying the tools shown. Up to 4 marks allowable for specific constructional details such as materials, joints, processes. Do **not** allow generic answers like 'wood' – items should be named, sketched and appropriate. List-like answers detailing required features can score full marks.

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
19	**(a)***		Candidates should discuss how aluminium and plastics properties (light weight, malleability and corrosion resistance) have contributed to better fuel economy, improved vehicle life-spans, improved safety features such as impact absorption.	**6**	Maximum of 2 marks for short bullet point list.	**Level 3 (5-6 marks)** Thorough discussion, with examples, of how the lightweight properties of aluminium and plastics have contributed to improved safety, economy and performance of vehicles. 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. **Level 2 (3-4 marks)** Sound discussion, possibly with an example, of how the lightweight properties of aluminium and plastics have contributed to improved safety, economy and performance of vehicles. 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.

Question			Answer	Marks	Guidance	
					Content	Levels of response
						Level 1 (1-2 marks) Basic discussion, possibly without any example, of how the lightweight properties of aluminium and plastics have contributed to improved safety, economy and performance of vehicles. 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. **(0) response worthy of no marks**

Question			Answer	Marks	Guidance
	(b)		Any two of: • To improve the mechanical performance • Modify tensile strength • Improve machinability • Confer specialist behaviour (corrosion or fatigue resistance)	**2**	Accept any other valid alternative.
	(c)	**(i)**	One mark for each correct label: • Fulcrum (F) (at rivet above operating lever) • Effort (E) on bottom half/part of operating levers • Load (L) at end of lever / in-between plastic jaws	**3**	
		(ii)	Any of: • Prevents marking softer surfaces • Improved grip • Increased surface area • Easily moulded	**2**	Accept any other valid alternative**.**

Question			Answer	Marks	Guidance
		(iii)	The **oscillating** motion of the operating lever is converted to **linear** motion in the jaws.	**2**	Accept any recognisable spelling.

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553