OCR
Oxford Cambridge and RSA

GCSE

Design and Technology: Electronics and Control Systems

Unit **A515/02**: Sustainability and technical aspects of designing and making pneumatics

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions)
Subject specific - insert details in table making sure that the annotation matches the image that appears on scoris®.
Your Qualifications Manager or Qualifications Leader will be able to help.

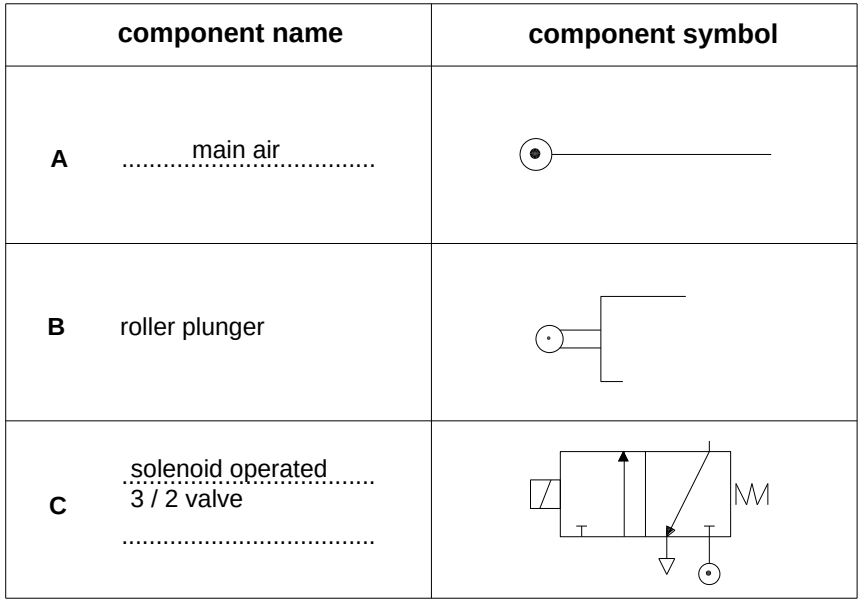
Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓	correct response
X	Incorrect response
L1	level 1 response in (*) question
L2	level 2 respconse in (*) question
L3	level 3 response in (*) question
BOD	Benefit of doubt
SEEN	Nothing written or drawn, NR allocated as mark or worthy of no marks
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 must be correct for mark
7			Any of: • 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: • Winding handle • Solar panel • Tuning dial • Telescopic aerial • Volume/on/off switch • Speaker grill	3	Allow any other valid response.
	(b)		Any of: • Means that you don't have to keep on winding	1	Answer must reference charging method

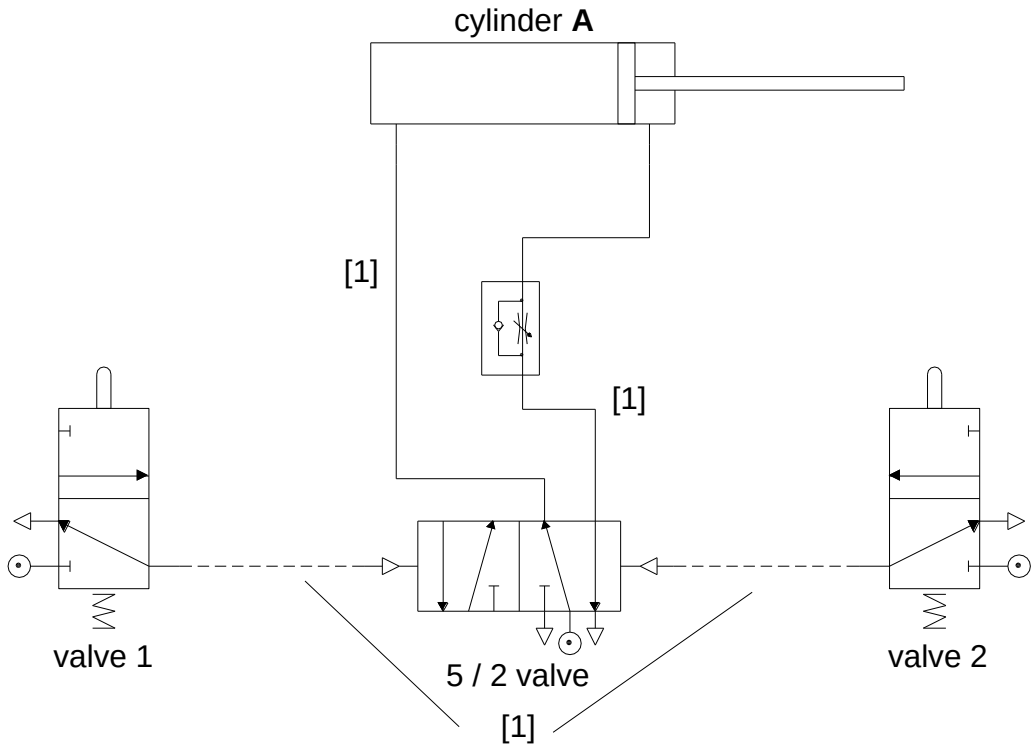
Question			Answer	Mark	Guidance
			• Always ready to use (if it was charged up previously) • Long product life • Reduces built-in obsolescence • Could accept power from other sources e.g. solar		
	(c)		Any of: • Can be taken apart for recycling of case and components • Rechargeable battery can be disposed of safely • 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	**2**	'Quick' or 'fast' needs to be qualified for a mark. Allow reference to repair
	(d)		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: • 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 • facing sunlight • operating controls	**3**	Allow equivalent actions that would work in some way. Principle is required rather than high levels of artistic accuracy.

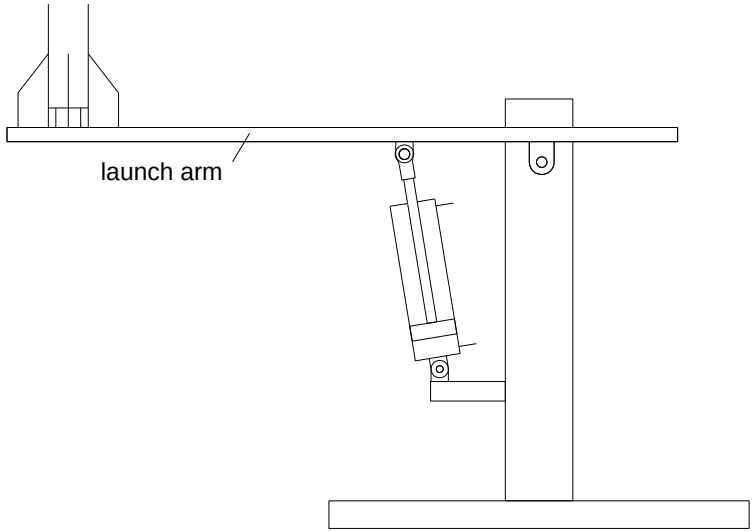
Question			Answer	Marks	Guidance	
					Content	Levels of response
	(g)*		Candidates should identify the benefits to the end-user. E.g. • less reliance on bought in power / batteries • fuel use reduced e.g kerosene/paraffin for lighting, diesel / petrol for generators, mains electricity. • Circuitry can be optimised for low consumption so it makes better use of limited energy. • Examples given of other products that use 'wind up' technology'. • Use of radio for keeping up to date with news. • Use of radio for emergencies.	6	Maximum of 2 marks for short bullet point list	**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. **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 **Level 1 (1-2 marks)** Basic explanation, showing limited understanding of how wind-up

Question			Answer	Marks	Guidance	
					Content	Levels of response
						products can improve the day to day lives of people in third world 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. **(0)** Response worthy of no marks
			Question 16 total	**20**		
			Section A Total	**35**		

Question			Answer	Mark	Guidance
17	(a)			[1]	Must refer to air
			A ..... main air	[1]	
			B roller plunger	[2]	Solenoid operated [1] 3/2 valve, 3 port or spring return [1]
			C ..... solenoid operated ..... 3 / 2 valve		
	(b)	(i)		[2]	Any two valid points, 2 x 1 marks Allow marks for understanding shown.
		(ii)		[2]	Allow 2 marks for a detailed explanation of one point.
		(iii)	A large receiver is used to store the compressed air [1] so that compressor does not need to run constantly [1] and to supply a constant pressure to the pneumatic system over a period of time [1].	[2]	Do not allow 'strong' unless qualified Allow other valid responses.
	(c)	(i)	There is a tap on the lowest point of the receiver to drain any water that has been produced during compression of the air [1]. The water must be drained off to prevent corrosion [1]	[1]	
		(ii)	Benefits of mild steel – low cost [1], can be welded / joined easily [1] can be rolled / formed into shape [1], strong in tension so will contain a high pressure [1] Any one for a suitable benefit.	[2]	Must refer to turning force not pressure

	(d)		Drawbacks of mild steel – will corrode on the inside of tank [1] without any visible evidence on outside [1] Can be heavy / hard to move [1] Any one for a suitable drawback. Tool **A** is a pair of long nose pliers – not suitabel as the jaws **do not close parallel**, **can easily slip** of a hexagon nut, serrations on plier jaws **can damage the nut**. Any one valid point for a mark. Torque is the turning force applied to the nut [1] the maximum torque specified is the highest safe torque that can be applied [1] Areas to be checked before connecting to air supply are: • All pipe connections secure [1] • Pressure output from receiver tank is at a safe level [1] • All components should be securely fixed to base [1] • Test movement of DAC [1]. Any two valid checks 2 x 1 marks.	**[2]**	Allow 2 marks for a detailed description of one point
			TOTAL	**[15]**	

Question			Answer	Mark	Guidance
18	(a)	(i)		**[3]**	Allow uni directional restrictor on either line. Air supply for cylinder **A** must come from HS of 5 port valve.
		(ii)	Valve 2 has been pressed and released to outstroke the cylinder.	**[1]**	
	(b)	(i)		**[2]**	

Question			Answer	Mark	Guidance
			 Cylinder placed on left of centre support [1] Cylinder shown as instroked [1]		Allow any other workable arrangement
	(c)		Cylinder **A** should be outstroking right to the end of the stroke for maximum effect on the launch. The sudden stop helps the launch.	**[1]**	
	(d)	**(i)**	The operating valves are shown 3m apart which is further than one persons arm stretch, therefore two people will be needed.	**[1]**	Must refer to the need for two people
		(ii)	The arrangement is an AND gate	**[1]**	

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
	(e)*		The following points may be included in the response: • Cost of components / PLCs computers • Changes needed in workshop layout • Likely benefits of the change • Additional training for staff • Different workforce skills • Interchangeable programs • Reduction in set up time • Sequences can be changed quickly so processes can be refined • Remote operation and editing of sequences. Examples of an electro-pneumatic computer control system should be included for level 3.	**[6]**		**Level 3 (5-6 marks)** Shows detailed understanding of the electro-pneumatic computer control system and implications for manufacturer. Suitable examples used. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar. **Level 2 (3-4 marks)** Shows some understanding of the introduction of electro-pneumatic computer control system There will be some use of specialist terms although theses 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, punctuation and grammar. **Level 1 (0-2marks)** Shows limited understanding of electro-pneumatic computer control system . No examples used. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of grammar, punctuation and spelling may be intrusive. **(0)** Response worthy of no marks.
			TOTAL	**[15]**		

Question			Answer	Mark	Guidance
19	(a)		1 mark for single instroke and outstroke for each cylinder. 1 mark for correct sequence B+ | A- | B- | A+	[2]	1 for A- 1 for other 2 Allow **B+ A- A+ B-**
	(b)		F = P x A Outstroke piston area = Π x 12.5^2 = $490.87mm^2$ [1] Piston rod area = Π x 2.5^2 = $19.63mm^2$ [1] Instroke piston area = 490.87 – 19.63 = $471.24\ mm^2$ [1] Outstroke pressure = F / A = 40 / 490.87 = $0.08Nmm^2$ [1] Instroke pressure = 40 / 471.24 = $0.085N\ mm^2$ [1]	[5]	Full marks for correct answers with no working.
	(c)		Sensor specified [1] Suitable position for sensor shown / described [1] Method for sending signal from sensor shown [1] Decision method - PLC / computer / direct to pneumatic circuit [1] Output signal to cylinder shown [1] Functional method used [1]	[6]	One example shown, a range of methods could be used.
	(d)		Reasons for prototyping could be: • Testing circuit hardware • Ensure that final design is error free by identifying faults • Testing mechanism • Setting up PLC / software • Risk assessment • Reduced costs if system fails • Have a working design to show potential investors 2 x 1 marks for suitable reasons.	[2]	
			TOTAL	**[15]**	

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