A-LEVEL

DESIGN AND TECHNOLOGY: SYSTEMS AND CONTROL TECHNOLOGY

SYST3 Design and Manufacture
Mark scheme

2556
June 2014

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

Section 1

Question 1			
0 1	Non-renewable are finite and will therefore run out in time – Limited natural resources in the UK of finite energy – oil is running out – gas is running out – coal is plentiful – no uranium – Energy security – importing of energy – balance of payments - pollution caused by finite energy sources – pollution caused by transporting energy – countries energy requirements fluctuate hour to hour – energy generation cannot be switched on or off quickly to match demand – wind / wave / solar / tidal rise and fall only suitable at certain times or certain weather conditions – limited methods of storing mass energy – Inability of renewable to produce all of UK requirements – Cost of production methods both capital and running – transmission of energy from production site to end user – International commitments to pollution reduction – Etc.		Max 16 marks
	Marks awarded as follows:		
	Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate examples to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion. Sentences and paragraphs may not always be well connected and there will be a number of grammatical, punctuation and spelling errors.	0 – 5	
	Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant examples will be given. There are likely to be some inaccuracies and misunderstandings, especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly if not always fluently. There will be some grammatical, punctuation and spelling errors.	6 – 10	
	Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant examples. The information will be detailed and accurate. Complex ideas will be expressed clearly and fluently with few, if any, errors of grammar, punctuation and spelling.	11 - 16	

0 2	Reduced pollution from the actual vehicle (Chemical) – Reduced pollution from the actual vehicle (Noise) – Pollution at initial point of production – Visual pollution overhead power lines for transmission – Overhead power for trains – Capital costs of electrifying railways – inability of trains to run on non-electrified lines – access to an electrical supply – storage problems – battery life – need for recharging – solar power option limited – efficient drive system – lightweight power units in relation to power produced – easily controllable – efficient little energy wastage – Etc. **Marks awarded as follows:** Basic information with evidence of only simplistic understanding of the selected influence. Candidate will give only a narrow range of points with few, if any, appropriate examples. There will be many inaccuracies and confusion. Sentences and paragraphs may not always be well connected and there will be a number of grammatical, punctuation and spelling errors.		Max 12 marks
	Basic information with evidence of only simplistic understanding of the selected influence. Candidate will give only a narrow range of points with few, if any, appropriate examples. There will be many inaccuracies and confusion. Sentences and paragraphs may not always be well connected and there will be a number of grammatical, punctuation and spelling errors.	0 – 4	
	Candidate shows some sound knowledge and understanding. There will be a lack of precise and accurate detail at the lower end of the mark range. A range of relevant examples will be given, though this may be limited at the lower end of the range. There are likely to be some inaccuracies and misunderstandings. Straightforward ideas are expressed reasonably clearly if not always fluently. There will be some grammatical, punctuation and spelling errors.	5 – 8	
	Candidate shows detailed knowledge and understanding and gives a wide range of relevant examples to illustrate points made. The information will be detailed and accurate. At the lower end of the mark range they will show sound knowledge and understanding but there may be a lack of detail. Complex ideas will be expressed clearly and fluently with few, if any, errors of grammar, punctuation and spelling.	9 - 12	

Question 2			
0 3	Reference to the materials being joined - suitable method for joining those materials - appropriate joint preparation - any additional component required e.g. flux / brazing rod - explanation of process – equipment used - sequence of operation – relevant parameters e.g. temperature – reference to suitable real life application - reason for choice. Etc. (**semi-permanent method eg. Nut and Bolt Max 6)** **Marks awarded as follows:** Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion. Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly. Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly.	0 – 2 3 – 5 6 – 8	Max 2 x 8 marks

0 4			Max 12 marks
	Capital set up costs – running cost – manufacturing times – suitability for different materials – size of production run – complexity of component being manufactured – complexity of machining operations – material being used – quality of finish – accuracy requirements – strength and grain structure – distortion of component – Etc. **Marks awarded as follows:** Basic information with evidence of only simplistic understanding. Candidate will give only a narrow range of points with few, if any, appropriate examples. There will be many inaccuracies and confusion.	0 – 4	
	Candidate shows some sound knowledge and understanding. There will be a lack of precise and accurate detail at the lower end of the mark range. A range of relevant examples will be given, though this may be limited at the lower end of the range. There are likely to be some inaccuracies and misunderstandings. Straightforward ideas are expressed reasonably clearly.	5 – 8	
	Candidate shows detailed knowledge and understanding and gives a wide range of relevant examples to illustrate points made. The information will be detailed and accurate. At the lower end of the mark range they will show sound knowledge and understanding but there may be a lack of detail. Complex ideas will be expressed clearly.	9 - 12	

Question 3			
0 5	Reference to product - **suitable destructive test** used in development – reasons why the test is necessary – for development – for manufacturer – for end user - data that would be gained from the test - how the data would be measured – how it will be recorded – parameters - description /explanation of the test – how the outcome of the test will inform the products development. Etc.		Max 2 x 8 marks
	Marks awarded as follows: Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion.	0 – 2	
	Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly.	3 – 5	
	Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly	6 - 8	
0 6	Reference to product - **suitable non-destructive test** used in development – reasons why the test is necessary – for development – for manufacturer – for end user - data that would be gained from the test - how the data would be measured – how it will be recorded – parameters - description /explanation of the test – how the outcome of the test will inform the products development. Etc.		Max 2 x 6 marks
	Marks awarded as follows: Basic information with evidence of only limited understanding. There will be little explanation. There will be inaccuracies and confusion.	0 – 2	
	Candidate shows some sound understanding and gives a satisfactory although there will be some omissions and minor inaccuracies. The candidate has good understanding but there is a lack of detailed knowledge in the explanation. Straightforward ideas are expressed clearly.	3 – 4	
	Candidate shows detailed knowledge and understanding and gives a clear and accurate explanation. Complex ideas will be expressed clearly.	5 – 6	

Question 4			
0 7	Suitable power supply for sequencing system - activation system or start point - suitable sub-system for producing a sequence – capable of at least 4 steps – producing 4 outputs – sub-system for driving coils – compatible with voltage and current requirements – method for repetition of sequence - explanation of how the sub-systems interact – explanation of the complete system. Etc. **Marks awarded as follows:** Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion.	0 – 2	Max 2 x 8 marks
	Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly.	3 – 5	
	Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly.	6 - 8	
0 8	Activation method for the reversing the system – how it can be activated at any point in the sequence – the effect it has on the sequence – how the sequence is modified - explanation of system – Etc. **Marks awarded as follows:** Basic information with evidence of only limited understanding. There will be little explanation. There will be inaccuracies and confusion.	0 – 2	Max 6 marks
	Candidate shows some sound understanding and gives a satisfactory although there will be some omissions and minor inaccuracies. The candidate has good understanding but there is a lack of detailed knowledge in the explanation. Straightforward ideas are expressed clearly.	3 – 4	
	Candidate shows detailed knowledge and understanding and gives a clear and accurate explanation. Complex ideas will be expressed clearly.	5 - 6	

| 0 9 | **Input**
Can only be accessed at a specified point
Needs a comparison
Part of programme sequence

Interrupt
Accessible at all times
Breaks the sequence of operations to do something else
Remembers state of program and returns to that point

Suitable use with reason eg. Emergency stop because it can override what the program is doing at that point in time.

Marks awarded as follows:

Basic information with evidence of only limited understanding. There will be little explanation. There will be inaccuracies and confusion.

Candidate shows some sound understanding and gives a satisfactory although there will be some omissions and minor inaccuracies. The candidate has good understanding but there is a lack of detailed knowledge in the explanation. Straightforward ideas are expressed clearly.

Candidate shows detailed knowledge and understanding and gives a clear and accurate explanation. Complex ideas will be expressed clearly. | 0 – 2

3 – 4

5 – 6 | Max 6 marks |

Question 5			
1 0	Appropriate method of activating the system - suitable sub-system for 5 second delay - suitable sub-system for extending D/A cylinder quickly - suitable sub-system for providing a 20 second delay - suitable sub-system to control inward movement - Interconnection of sub-systems to ensure reliable operation - description / explanation of individual sub-systems and whole system.		Max 16 marks
	Marks awarded as follows:		
	Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate examples to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion.	0 – 5	
	Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant examples will be given. There are likely to be some inaccuracies and misunderstandings, especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly.	6 – 10	
	Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant examples. The information will be detailed and accurate. Complex ideas will be expressed clearly.	11 – 16	

1 1	Hygiene - safety in moist situations - the type of force required - the magnitude of the force - ease of adjustment - lack of pollution -Limited control of positional movement - limited control options - need for interfacing with electrical control - capital costs – infrastructure – need for compressor – safety requirements – possible dangers - do not burn out if stalled - useful in hazardous situations - limited operational speed – large operational force . Etc.		Max 12 marks
	Marks awarded as follows:		
	Basic information with evidence of only simplistic understanding. Candidate will give only a narrow range of points with few, if any, appropriate examples. There will be many inaccuracies and confusion.	0 – 4	
	Candidate shows some sound knowledge and understanding. There will be a lack of precise and accurate detail at the lower end of the mark range. A range of relevant examples will be given, though this may be limited at the lower end of the range. There are likely to be some inaccuracies and misunderstandings. Straightforward ideas are expressed reasonably clearly.	5 – 8	
	Candidate shows detailed knowledge and understanding and gives a wide range of relevant examples to illustrate points made. The information will be detailed and accurate. At the lower end of the mark range they will show sound knowledge and understanding but there may be a lack of detail. Complex ideas will be expressed clearly.	9 – 12	

Question 6			
1 2	Suitable prime mover - capable of loading requirement – suitable power source - sub-system capable of 400mm of linear movement – sub-system fit for purpose – a drive /control sub-system for prime mover - sub-system connecting prime mover to CNC movement - support/ guidance of drive system - method providing 0.01 mm accuracy - appropriate calculations / conversion for accuracy - explanation of sub-systems and complete system. Etc. **Marks awarded as follows:** Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate examples to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion. Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant examples will be given. There are likely to be some inaccuracies and misunderstandings, especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly. Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant examples. The information will be detailed and accurate. Complex ideas will be expressed clearly.	0 – 5 6 -10 11 – 16	Max 16 marks

1 3	Exemplar points:		Max 12 marks
	Electrical Readily available power source - range of prime movers available - control circuits readily available - range of control options - range of activation sensors - need to interface with high power prime movers - feedback easily fitted - need for mechanical conversion to provide linear movement – Etc. **Pneumatic** Air supply required - produces linear movement directly - speed controllable - force controllable - quiet operation - limited control options - needs interfacing to sensors or electronics - simplified movement system – Etc.		
	Marks awarded as follows:		
	Basic information with evidence of only simplistic understanding. Candidate will give only a narrow range of points with few, if any, appropriate examples. There will be many inaccuracies and confusion.	0 – 4	
	Candidate shows some sound knowledge and understanding. There will be a lack of precise and accurate detail at the lower end of the mark range. A range of relevant examples will be given, though this may be limited at the lower end of the range. There are likely to be some inaccuracies and misunderstandings. Straightforward ideas are expressed reasonably clearly.	5 – 8	
	Candidate shows detailed knowledge and understanding and gives a wide range of relevant examples to illustrate points made. The information will be detailed and accurate. At the lower end of the mark range they will show sound knowledge and understanding but there may be a lack of detail. Complex ideas will be expressed clearly.	9 - 12	