GCSE 2003
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Report on the Examination

Design and Technology: Systems and Control Technology
3546

■ Full Course

Further copies of this Report on the Examination are available from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee, registered in England and Wales 3644723 and a registered Charity 1073334. Registered address Addleshaw Goddard, Sovereign House, PO Box 8, Sovereign Street, Leeds LS1 1HQ.
Kathleen Tattersall, Director General

CONTENTS

Full Course

Page No.

Full Course Foundation 5
Full Course Higher 9
Coursework 13

Mark Ranges and Award of Grades 16

Design and Technology: Systems and Control Technology

General

Candidates performed reasonably well across all of the papers although many found the questions requiring them to identify components and mechanisms very difficult. The design questions were generally well tackled, as were the algorithm questions. It was pleasing to see that candidates had an understanding of how systems are integrated and they were able to appreciate the way in which electronic control systems are related to mechanical and pneumatic outputs.

The papers tested a wide breadth of the specification but candidate responses suggested that some of the areas had not been fully understood. Questions where this has been apparent are mentioned in the more detailed breakdown that follows. The reduced time for project work may give candidates an opportunity to reinforce some of the knowledge and content of the specification before they sit the examination papers.

It was pleasing to see that there were very few instances of candidates attempting to answer both sections of the papers. The papers will have two sections next year and just as this year there will be a number of questions that are identical in each of the sections. Algorithm, logic questions and electronic control circuits are common to both sections. The only questions that differ are the ones drawing upon the specialist knowledge of mechanisms or pneumatics. There were very small numbers of candidates attempting pneumatics at either tier.

Centres followed the instructions for dispatch well and there were few examples of late arriving scripts or scripts that were not placed in candidate order number.

Foundation

Section A

Question A1

In part (a) resistors and motors were correctly identified by the majority of candidates. However, many candidates confused the capacitor for a battery and the transistor, fuse and push to make switch were badly identified. In part (b) candidates either identified all motions correctly or showed a great degree of confusion when naming the motions. Part (c) was very well answered with the vast majority of candidates able to identify the cam and the follower correctly. Many candidates found difficulty in drawing a diagram to show a microswitch placed in series with a switch to perform the safety function required for a drill guard in part (d) of the question. The most able candidates scored highly on this question and demonstrated good basic circuit design.

Question A2

This question was not well answered. In part (a) the most correctly identified pin was the output pin. Surprisingly few candidates managed to interpret the diagram to label 0v and 9v. Only the more able candidates were able to suggest polarity as a response to the insertion of the diode. In part (b) candidates were generally aware that they needed to indicate a resistor and capacitor but often selected the wrong ones. Part (c) was disappointing. Identification of resistor values is a fairly low level skill but few candidates were able to do this correctly let alone be aware of operational tolerances. Most candidates were able to give a correct reason for the necessity for the resistor being placed in series with the LED. In part (d) candidates that realised that the required response was to do with fixing and handling the components usually gave good answers. The final part of the question was to do with the location of a circuit board, which is a basic constructional process, and it was disappointing to see large numbers of candidates leaving this question blank. Where candidates had used proprietary components to do this they answered the question well. Hot glue gun and sticky tape were frequently given as responses and they are not the most appropriate methods.

Question A3

When identifying the mechanisms the most frequent answer to part (a) was a rack and pinion and candidates had failed to identify that the drawing had a rotating shaft labelled to help them identify it as a worm gear. Very few candidates correctly identified the gear as a bevel gear. Where the bevel gear was correctly identified candidates nearly always stated the correct answer for this part of the question. Despite some problems with spacing on part (d) the more able candidates added an idler and a gear wheel and indicated the number of teeth that would allow the output shaft to rotate at half the speed of the input shaft. In the final part of the question many candidates gave general safety responses rather than looking at the safety precautions that are used in gear systems. Few mentioned enclosed gears and microswitch protected guards etc..

Question A4

Candidate responses did not suggest a good understanding of the injection moulding process; many confusing it with vacuum forming. In part (b) the more able candidates did add a functional web to the drawing given. Most candidates selected thermoplastic as the response to part (c) and stated correctly that it could be re-melted. Few candidates recognised that the plastic components were granulated before being re-used. The final part of this question was often left blank with surprisingly few candidates attempting to draw even a simple nut and bolt. It is surprising that candidates specialising in mechanisms were not aware how linkages are fastened together.

Question A5

The first part of this question was generally well answered by the majority of candidates with most realising there was a quick fall after a slow rise. However many candidates did not attempt the second part of the question. When it was answered candidates performed well. Many used the cam illustrated in their solution rather than a cam that would give the same speed rise and fall.

Question A6

Part (a) was well answered although many of the symbols drawn were inaccurate. The flow chart in part (b) was generally well answered with candidates putting the correct responses inside the correct symbols. When answering part (c) candidates tended to scored either very well or very badly. Logic gate symbols and truth tables should be within the reach of all candidates performing at Foundation level. Candidates scored well on part (d) of this question when it was attempted although few could explain the function of the diode within the circuit shown. A relay is a standard component used to interface low voltage control and higher voltage circuits that candidates should be aware of but responses to the final part of the question suggested a lack of familiarity with this component.

Question A7

This question was well answered throughout. Most candidates were able to state advantages and disadvantages of CAD. However, some candidates had difficulty differentiating between CAD and CAM. Knowledge of the licensing issues of software was generally answered correctly. When answering part (c) many one-word answers were offered that related to CAD rather than CAM solutions. Parts (d) and (e) were well answered although some candidates incorrectly made reference to product improvement when answering the final part of the question.

Question A8

This question was answered well by the more able candidates but most found difficulty in incorporating the audible output into their design proposals. The use of appropriate mechanisms for raising and lowering the barriers allowed candidates to draw upon their experience of making working models etc.. The drawn responses were of an appropriate quality and it was pleasing to see that most candidates were stating specific materials rather than generic materials.

Foundation Paper

Section B

Question B1

The majority of candidates correctly identified resistors and motors. However, many candidates confused the capacitor for a battery and the transistor, fuse and push to make switch were badly identified. In part (b) candidates identified the majority of the components well although it was surprising that some struggled with the spring-operated symbol. Part (c) was very well answered with the vast majority of candidates able to identify the piston and the roller correctly. In the final aprt of the question many candidates found difficulty with the basic circuit diagram and the question was often omitted. The AND function is a common pneumatic circuit that candidates should be able to draw using suitable component symbols.

Question B2

This question was not well answered. In part (a) the most correctly identified pin was the output pin. Surprisingly few candidates managed to interpret the diagram to label 0v and 9v. Only the more able candidates were able to suggest polarity as a response to the insertion of the diode. In part (b) candidates were generally aware that they needed to indicate a resistor and capacitor but often selected the wrong ones. Part (c) was disappointing. Identification of resistor values is a fairly low level skill but few candidates were able to do this correctly let alone be aware of operational tolerances. Most candidates were able to give a correct reason for the necessity for the resistor being placed in series with the LED. In part (d) candidates that realised that the required response was to do with fixing and handling the components usually gave good answers. The final part of the question was to do with the location of a circuit board, which is a basic constructional process, and it was disappointing to see large numbers of candidates leaving this question blank. Where candidates had used proprietary components to do this they answered the question well. Hot glue gun and sticky tape were frequently given as responses and they are not the most appropriate methods.

Question B3

In the first part of the question the valve was often described successfully with many candidates using a selection from the following correct terms - button operated, 3 port valve, spring return, cylinder to exhaust, two position valve. When required to construct a circuit diagram in part (b) many candidates were able to correctly draw the components but did not place them in the order that was required for the circuit to function as requested. The final part of the question was very poorly answered. Candidates at all levels are expected to be able to perform basic calculations on force and area of pistons.

Question B4

Candidate responses did not suggest a good understanding of the injection moulding process; many confusing it with vacuum forming. In part (b) the more able candidates did add a functional web to the drawing given. Most candidates selected thermoplastic as the response to part (c) and stated correctly that it could be re-melted. Few candidates recognised that the plastic components were granulated before being re-used. The final part of this question was often left blank with surprisingly few candidates attempting to draw even a simple nut and bolt. It is surprising that candidates specialising in mechanisms were not aware how linkages are fastened together.

Question B5

The first part of the question was generally well answered with most candidates correctly describing at least what happens when valve A is activated. In part (b) candidate responses were poor with few candidates correctly identifying the need for a flow control valve and then redrawing the circuit with the valve in the correct orientation and position. The final part of this question was quite well answered by the majority of candidates.

Question B6

Part (a) was well answered although many of the symbols drawn were inaccurate. The flow chart in part (b) was generally well answered with candidates putting the correct responses inside the correct symbols. When answering part (c) candidates tended to score very well or very badly. Logic gate symbols and truth tables should be within the reach of all candidates performing at Foundation level. Candidates scored well on part (d) of this question when it was attempted although few could explain the function of the diode within the circuit shown. A relay is a standard component used to interface

low voltage control and higher voltage circuits that candidates should be aware of. Responses to the final part of the question suggested a lack of familiarity with this component.

Question B7

This question was well answered throughout. Most candidates were able to state advantages and disadvantages of CAD. However, some candidates had difficulty differentiating between CAD and CAM. Knowledge of the licensing issues of software was generally answered correctly. When answering part (c) many one-word answers were offered that related to CAD rather than CAM solutions. Parts (d) and (e) were well answered although some candidates incorrectly made reference to product improvement when answering the final part of the question.

Question B8

This question was not well answered. Candidates were often unable to demonstrate a suitable circuit and pneumatic mechanism to raise and lower the barriers. Where attempted the drawings were usually of an appropriate standard and the symbols and conventions used were generally appropriate.

Higher Paper

Section A

Question A1

Performance on this question was either very good or very poor. Where candidates had experience of using the 555 Integrated Circuit they performed very well. However, even without knowledge it should have been possible to look at the circuit diagram to complete pins 1, 3 and 8. Part (b) was answered well by the majority of candidates. However, in part (c) some of the responses were disappointing for candidates working at this tier. The LDR symbol should be a known symbol but many were unable to draw it correctly irrespective of ensuring the correct position for sensing a dropping light level. Interfacing circuits is a major element in control systems and it was surprising to see that many candidates struggled with the concept of adding a relay and protection diode in the final part of this question. There were very few examples of entirely correct and appropriate responses.

Question A2

In the first part of the question the vast majority of candidates successfully identified the type of mechanism although there were a surprising number of candidates suggesting rack and pinion despite the text stating it was rotating shaft. Part (b) was invariably answered correctly and appropriately although the quality of drawn response was often surprisingly poor. Similarly in part (c) candidates performing at this tier almost always had the answer correct. The most common incorrect answer was 'complex gear train'. Calculations on gear ratios are fundamental to producing required speeds on rotating shafts and candidates either scored the full range of 6 marks or only gained marks for using the first ratio and stating the units of rotation when answering part (d). In the final part of the question responses varied greatly in quality. Many candidates describing inappropriate advantages and disadvantages.

Question A3

Candidates either scored very well or very badly on this question. The best responses showed a clear understanding of a common manufacturing process and produced good quality drawn responses. In the second part of the question the use of a web to strengthen the component shown was undertaken well by the majority of candidates. Few candidates were able to successfully identify and communicate a roller bearing.

Question A4

The cam profile was well answered. High quality responses were presented by the majority of candidates. Many candidates correctly identified and illustrated a roller bearing. The quality of response for this question was quite pleasing. Part (c) of the question was well answered in relation to the up and down movement but candidates struggled to show effective ways of producing the rotation. The more able candidates did use an offset cam to do this but many complex and unworkable suggestions were presented.

Question A5

Candidates on this tier correctly identified appropriate advantages of CAD and there were few instances of confusion between CAD and CAM. Part (b) of the question was well answered and the vast majority of candidates showed a clear understanding of the licensing of software. It was pleasing to see that candidates gave appropriate CAM responses; most identifying health and safety issues and product consistency. The final parts of the question were well answered by all candidates.

Question A6

This question was well answered by the more able candidates but many candidates incorrectly produced a flowchart that showed the gate operated by the pressure pad. The concept of feedback to a decision box was well understood by the vast majority of candidates. Most candidates were able to successfully complete the binary series required to produce the stated outputs to the seven segment display. In part (c) many candidates were able to state that a relay would be used but few were able to say why it was suitable. Responses to the final part of this question were good. Candidates used a variety of means to show how the triggering mechanism would work. However, many candidates missed the key words 'mechanical mechanism' and proceeded to show a variety of beam activated devices. Annotation was usually very good and entirely appropriate.

Question A7

This was a difficult question and many candidates struggled to incorporate all of the procedures required. Most successfully produced a subroutine or subsystem for checking the proximity to the wall before lowering the tailgate to the horizontal position. Many used a sensor to check that there was nothing under the tailgate before lowering commenced. Only the more able candidates were able to ensure a feedback loop during the lowering process to activate a stop routine and sound the audible alarm. The vast majority of candidates used a flow chart format rather than an algorithm to answer this question. Either format was equally acceptable.

Higher Paper

Section B

Question B1

Performance on this question was either very good or very poor. Where candidates had experience of using the 555 Integrated Circuit they performed very well. However, even without knowledge it should have been possible to look at the circuit diagram to complete pins 1, 3 and 8. Part (b) was answered well by the majority of candidates. However, in part (c) some of the responses were disappointing for candidates working at this tier. The LDR symbol should be a known symbol but many were unable to draw it correctly irrespective of ensuring the correct position for sensing a dropping light level. An Interfacing circuit is a major element in control systems and it was surprising to see that many candidates struggled with the concept of adding a relay and protection diode in the final part of this question. There were very few examples of entirely correct and appropriate responses.

Question B2

The majority of candidates successfully identified four of the key features of the valve illustrated and showed a good understanding of components. They were also able to use appropriate graphical techniques to produce the simple basic circuit required for a time delay. Part (c) of the question was well answered by most of the candidates. The basic calculations for force in pneumatic systems were clearly understood. In the final part of the question most candidates showed an awareness of fail safe systems and how they need to have separate power to return to the safe position. The description of a suitable industrial system was not answered with the same degree of success.

Question B3

Candidates either scored very well or very badly on this question. The more able responses showed a clear understanding of a common manufacturing process and produced good quality drawn responses. In the second part of the question the use of a web to strengthen the component shown was undertaken well by the majority of candidates. Few candidates were able to successfully identify and communicate a roller bearing.

Question B4

This question was poorly answered throughout. The main requirement was for the candidate to show the position of two activating mechanisms before the object is pushed into position. Many of the more able candidates used a roller at A which protruded above the horizontal surface and a plunger at B

which protruded through the vertical surface. When answering part (b) few candidates successfully completed the circuit diagram to show the AND function which is surprising as it is one of the basic pneumatic circuits that they should be aware of. In the final part of the question many candidates successfully completed the cylinder and the circuit diagram to show how the clamp would operate.

Question B5

Candidates on this tier correctly identified appropriate advantages of CAD and there were few instances of confusion between CAD and CAM. Part (b) of the question was well answered and the vast majority of candidates showed a clear understanding of the licensing of software. It was pleasing to see that candidates gave appropriate CAM responses; most identifying health and safety issues and product consistency. The final parts of the question were well answered by all candidates.

Question B6

This question was well answered by the more able candidates but many candidates incorrectly produced a flowchart that showed the gate operated by the pressure pad. The concept of feedback to a decision box was well understood by the vast majority of candidates. Most candidates were able to successfully complete the binary series required to produce the stated outputs to the seven segment display. In part (c) many candidates were able to state that a relay would be used but few were able to say why it was suitable. Responses to the final part of this question were poor with few candidates able to produce even a simple design for a closing gate. The more able candidates presented a combination of circuit diagrams and sketching to show how the valves and cylinders would operate. Where present annotation was usually good.

Question B7

This was a difficult question and many candidates struggled to incorporate all of the procedures required. Most successfully produced a subroutine or subsystem for checking the proximity to the wall before lowering the tailgate to the horizontal position. Many used a sensor to check that there was nothing under the tailgate before lowering commenced. Only the more able candidates were able to ensure a feedback loop during the lowering process to activate a stop routine and sound the audible alarm. The vast majority of candidates used a flow chart format rather than an algorithm to answer this question. Either format was equally acceptable.

Coursework

Administration

This is the first year of this examination and many centres must be congratulated for their development of the subject. Many centres produced work that was of high quality and that had been marked in accordance with the requirements of the Board. Moderators reported that most centres were within the tolerance set by the board.

Many centres included excellent annotation and this is very useful for moderators to help them understand where teachers have awarded marks.

Annotation is only needed where, help beyond normal learning support has been given to the candidate and where aspects of work have been assessed by the teacher but are no longer available for inspection. The moderator can only assess the work that is presented to them. In many centres only one teacher was involved in teaching the specification so internal standardisation was not a problem. However, where more than one teacher is involved, the internal standardisation process is essential so that the order of merit list is a true representation. This was the case in the majority of centres with more than one teacher teaching the subject, in a small number of centres, however, it was clear that this internal standardisation had not been carried out. Centres are reminded that coursework mark lists should be received by the AQA by the start of May and that requests for coursework samples are returned to the moderator as soon as possible.

General Comments

Each autumn, the Board holds a series of half-day training meetings for the specification. It is important that centres send a representative to these meetings so that specification requirements can be made clear and examples of work can be discussed.

The standard of outcomes continues to improve in centres. Centres need to be reminded that projects should be achievable within 40 hours; and that higher grades are still achievable within this time. At the other end of the spectrum, many unfinished 'inoperable outcomes were seen', suggesting the need for centres to match appropriate project outlines to lower ability students.

In this new specification students are encouraged, for the higher grades, to combine the core technology with their chosen focus technology. Most centres chose mechanisms as their focus technology, with few exploiting pneumatics. PIC technology is evident in the work of many centres this year which is pleasing. However, the use of PIC technology alone is not enough to guarantee a higher grade.

Moderators continue to look and give credit where it is evident to good work in the field of Systems and Control. The Systems and Control should be an integrated aspect of the project. However a few centres gave resistant material work in projects more credit than they should have done.

Bought-in parts, such as motors with gear boxes/PIC boards etc., although useful in achieving projects in 40 hours should not be used excessively or it becomes difficult for moderators to credit candidates own work. Centres are reminded that no projects should have a direct mains connection.

The shop display project proved very popular with centres and produced many successful outcomes across the ability range,

Although the vast majority of centres send well-presented work, carefully bound, and in order of merit to moderators, some centres still sent loose work, or several sheets in one plastic wallet, or work in large, bulky binders, complete with theory notes.

Major Project

Moderators continue to look for well finished, working projects which clearly show how Systems and Control had been used. Most centres direct their candidates successfully.

Design folders are expected to show evidence of how the candidates have researched and reached their design decisions. They should also include examples of industrial practice. Whilst most centres achieved this, others submitted folders containing large amounts of irrelevant research. This, coupled with poor task analysis, contributed to a great many vague specifications. In addition to this, although the established Systems approach of Input Process Output is evident in the work from most centres. In some folders final solutions still appear with almost a complete lack of system development. Some centres also deny their candidates access to the higher grades because they only have one process block in their project thus limited them to a grade C. In order to achieve above a grade C, projects must contain two process blocks in order to reflect core and focus technology.

Where PICs are used, it is important that candidates explain their programme/flow chart and note any changes and developments made. Some centres allowed commercially produced PIC programmes to be used or copied which is acceptable as long as they do not expect candidates to be credited for this. It is preferable for students to develop and modify their own programmes.

It was very encouraging to see so many outcomes fully functioning and combining different *"technologies"*. It is expected that simple systems will be complete and will work reliably. However, it is accepted that more complex ones may have problems. Moderators do not look for reasons to remove marks as long as candidates explain how they attempted to rectify any faults and modify their designs.

Evaluations were often weak or absent with candidates not allowing sufficient time for this. Successful candidates completed a detailed evaluation, by comparing their design with the original specification and field-testing their work. Centres should ensure candidates allow sufficient time for this.

Good use of ICT was evident in the work of many centres, with candidates using a variety of different software packages to achieve their desired outcome.

Many centres must be congratulated on producing very high quality Systems and Control work and adapting quickly to the changes bought about by the new specification.

Advice to centres

- Ensure candidates start a suitable task. It should include scope for them to show their true ability and use Systems and Control Technology.
- Start projects early and allow students plenty of time for testing and evaluation
- Consider matching students to project titles that they can achieve within 40 hours.

- Encourage students to highlight where decisions are made in the folders and explain why they made them.

- Use the assessment criteria and marking scheme with candidates, to show how they can improve grade.

- Encourage candidates to keep the research relevant to the project. It may include looking at how other products work and an interview with a potential user. This should also include an analysis, explaining what they have discovered.

- A clear and concise brief should be written. This need only be two or three sentences. The specification should be as detailed as possible, including measurable statements (e.g. *the final product must be no larger than 1OOmm x 50mm x 15mm, so it will fit in the user's pocket*)

- Candidates that use two process blocks will have access to the higher grades and are encouraged to combine different technologies – *Core and Focus*

- Ensure candidates record each stage of the project's development and modification. They should keep all their rough work and should not see the folder as an exercise in graphical presentation techniques.

- Set candidates intermediate deadlines for each stage of the project. The making always takes longer than expected and remember the major project has weighting of 1/3 designing and 2/3 making. For candidates to achieve high marks their project needs to be completed. This will also mean they will be able to carry out a detailed evaluation, which could include returning to the person they interviewed as part of their research.

- Introduce the concept of industrial practice as soon as possible in the course and talk to candidates about how this could form an integrated part of their coursework.

Encourage candidates to use ICT in so it is relevant to Design and Technology. It is better for them to show their skills in depth in a small range of software, rather than a shallow *"gloss over"* approach. A good working drawing using CAD or circuit/system design and development are better examples

Mark Ranges and Award of Grades

Although component grade boundaries are provided, these are advisory. Candidates' final grades depend on their total marks for the subject. In particular, A* is determined on candidates' total marks, not on each component, and candidates do not have to obtain 95 marks on the coursework component in order to gain grade A* on the subject as a whole.

Full Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
3546/F	125	140	55.1	21.7
3546/C	95	210	107.1	39.2
Foundation tier overall 3546	--	350	49.13	19.33

		Max. mark	C	D	E	F	G
3546/F boundary mark	raw	125	73	61	49	38	27
	scaled	140	82	68	55	43	30
3546/C boundary mark	raw	95	60	47	34	22	10
	scaled	210	133	104	75	49	22
Foundation tier scaled boundary mark		350	205	167	129	91	53

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
3546/H	125	140	67.8	21.2
3546/C	95	210	161.0	34.0
Higher tier overall 3546	--	350	60.46	18.94

		Max. mark	A*	A	B	C	D	allowed E
3546/H boundary mark	raw	125	87	76	65	54	37	-
	scaled	140	97	85	73	60	41	-
3546/C boundary mark	raw	95	95	83	71	60	43	-
	scaled	210	210	183	157	133	104	-
Higher tier scaled boundary mark		350	295	261	227	193	145	121

Although component grade boundaries are provided, these are advisory. Candidates' final grades depend on their total marks for the subject. In particular, A* is determined on candidates' total marks, not on each component, and candidates do not have to obtain 95 marks on the coursework component in order to gain grade A* on the subject as a whole.

Provisional statistics for the award

Foundation tier (3701 candidates)

	C	D	E	F	G
Cumulative %	20.6	45.6	69.7	86.2	94.9

Higher tier (3438 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	5.9	26.7	52.9	80.1	95.5	97.8

Overall (7139 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	2.9	12.9	25.5	49.3	69.6	83.2	91.8	96.3

Definitions

Boundary Mark: the minimum (scaled) mark required by a candidate to qualify for a given grade. Although component grade boundaries are provided, these are advisory. Candidates' final grades depend only on their total marks for the subject.

Mean Mark: is the sum of all candidates' marks divided by the number of candidates. In order to compare mean marks for different components, the mean mark (scaled) should be expressed as a percentage of the maximum mark (scaled).

Standard Deviation: a measure of the spread of candidates' marks. In most components, approximately two-thirds of all candidates lie in a range of plus or minus one standard deviation from the mean, and approximately 95% of all candidates lie in a range of plus or minus two standard deviations from the mean. In order to compare the standard deviations for different components, the standard deviation (scaled) should be expressed as a percentage of the maximum mark (scaled).