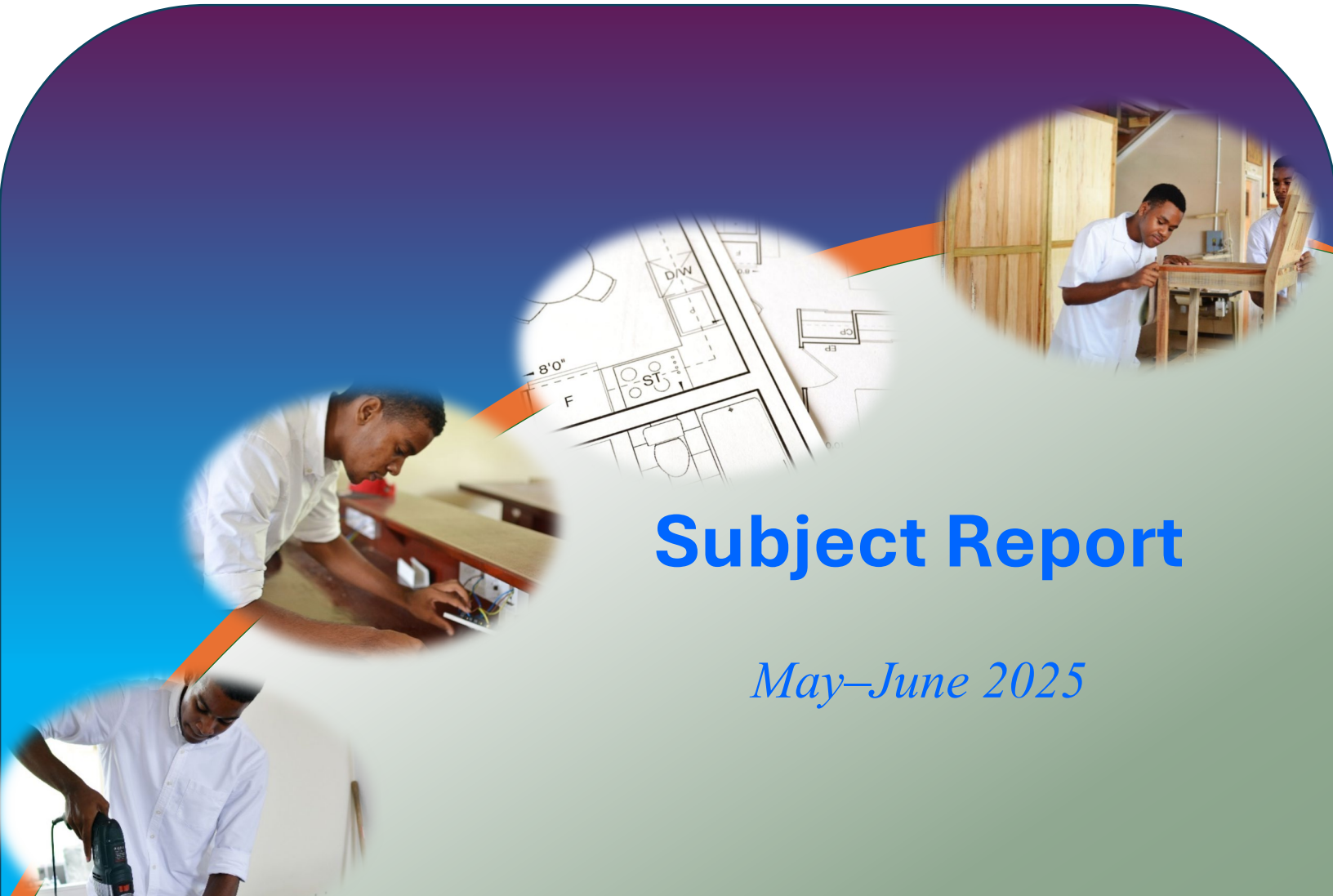
CARIBBEAN EXAMINATIONS COUNCIL

CAPE® BUILDING AND MECHANICAL ENGINEERING DRAWING

UNIT 1



Subject Report

May–June 2025

CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

MAY–JUNE 2025

BUILDING AND MECHANICAL ENGINEERING DRAWING
UNIT 1

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INTRODUCTION

This report is based on the May—June 2025 CAPE Unit 1 Building and Mechanical Engineering Drawing examination. Unit 1 — Building and Mechanical Engineering Drawing — consists of three modules.

- Module 1: Geometry 1
- Module 2: Geometry 2
- Module 3: Option A — Engineering Drawing or Option B — Building Drawing

This examination comprises the following papers.

- Paper 01 — Multiple Choice
- Paper 02 — Extended Response
- Paper 03 — Drawing Portfolio

In 2025, 246 candidates were registered for Unit 1, compared with 218 in 2024 and 214 in 2023. This shows an increase in the candidate entries over the last three years. The performance of candidates in 2025 was on par with the performance of candidates in previous years. Approximately 94 per cent of candidates achieved Grades I–V compared with 92.47 per cent in 2024 and 94.00 per cent in 2023.

Paper 01 — Multiple Choice

Paper 01 comprises 45 multiple-choice items, which consist of 15 items per module. All items are compulsory. Specific papers are designed to accommodate candidates pursuing qualifications in Option A or Option B. Both papers include 15 items from Module 1 and 15 items from Module 2, while the remaining 15 items come from either Module 3A or Module 3B. This paper is worth 90 marks, which represents 30 per cent of the overall grade.

In 2026, the highest score achieved by any candidate was 90. The mean score was 61.19 (67.98 per cent) and the standard deviation 14.97.

Paper 02 — Extended Response

Paper 02 consists of eight extended response questions arranged into four sections. Each section comprises two questions. The sections and the modules tested are outlined below.

- Section A — Module 1
- Section B — Module 2
- Section C — Module 3 (Option A)
- Section D — Module 3 (Option B)

Candidates are required to answer all questions from Sections A and B, and all questions in either section C or D. This paper is worth 40 per cent of the overall grade.

In 2026, the maximum available mark was 120. The highest score gained by any candidate was 111. The mean score was 36.66 (30.55 per cent) and the standard deviation 23.14.

Question 1

Question 1 assessed candidates' knowledge, application and drawing skills in constructing an epicycloid using appropriate geometric methods, identifying the curve and producing a tangent to the resulting curve. This task required candidates to have a sound understanding of the motion of a point on the circumference of a circle as it rolls without slipping along a base circle, as well as proficiency in tangential construction techniques.

Approximately 93 per cent of candidates attempted the construction of the epicycloid. Approximately 37 per cent of them performed fairly well to comprehensively and the remaining 63 per cent performed poorly to moderately.

Of the candidates who offered a fairly good or comprehensive response, approximately 43 per cent of them completed the epicycloid construction with the tangent, using the correct method. However, approximately 24 per cent of these candidates omitted the tangent construction, which was a critical component of the task. Overall, candidates who performed well were able to accurately produce both the rolling circle and a curve, as required. Furthermore, they were able to accurately plot the path of Point P and construct the tangent at the stipulated location from the centre.

Approximately 54 per cent of candidates offered a response that was poor to moderate. Of note is that these candidates did not complete the required construction but instead redrew the given diagram. These candidates were notably unable to accurately produce both the rolling circle and a curve. Furthermore, they were unable to plot the path of Point P accurately and construct the tangent at the stipulated location from the centre. Such candidates also could not correctly identify the type of locus construction to be done. Generally, these candidates struggled with plotting the point at successive

intervals, leading to incomplete or inaccurate curves. Additional errors included inconsistent division of the base and rolling circles, incorrect arc transfers and imprecise use of CAD tools

In conclusion, while the candidates made a commendable effort, the overall execution of the epicycloid construction and tangent drawing revealed several areas for improvement. With continued practice and targeted instruction, candidates' performance on similar geometrical tasks can be significantly enhanced.

Recommendations

To improve performance on this item, it is recommended that teachers reinforce students' conceptual understanding of the principles of standard engineering curves, particularly epicycloid construction. Additionally, increased hands-on practice with step-by-step constructions, using both manual and digital tools such as AutoCAD, can enhance students' accuracy and confidence. Moreover, emphasis should also be placed on teaching students' tangent construction methods and ensuring that they are comfortable with drawing tangents to both straight and curved paths. Classroom strategies such as integrating real-world applications can further strengthen student engagement and comprehension.

Question 2

For Question 2, candidates were asked to

- reproduce the shape in the given figure
- use the funicular (link) polygon method to find the centroid of an irregular shaped laminar that consists of multiple shapes and has a hole with a radius of 7.5 mm in the centre of one of the shapes.
- show all calculations for the drawing.

This question assessed candidates' knowledge, application and drawing skills. Overall, 88 per cent of candidates provided an answer. Their responses ranged from limited to comprehensive. Approximately one per cent of candidates provided a comprehensive response. Such candidates showed that they had a full understanding of what was required, which was to use the funicular (link) polygon method to find the centroid of the given irregularly shaped laminar. These candidates were also able to calculate the area of the given shapes — A, B, and C.

Candidates who gave a fairly good response knew how to reproduce the irregularly shaped laminar, find the centre of the Shapes A, B and C, and had fair understanding of how to construct the funicular polygon. However, they were not able to find the centroid. These candidates were also able to calculate the area of the given shapes. Some candidates knew how to subtract the area of the circular hole from the area of the square in Shape A.

Approximately six per cent of candidates performed moderately. These candidates were able to demonstrate that they knew how to reproduce the irregularly shaped laminar, find the centre of the shapes but could not accurately construct the funicular link and find the centroid. Approximately 45 per cent of these candidates were unable to calculate the area of the given shapes correctly which included subtracting the area of the circular hole from the area of the square in Shape A.

Approximately 80 per cent of candidates provided limited responses. These candidates were able to demonstrate that they understood how to reproduce the irregularly shaped laminar. However, they demonstrated limited to no understanding of how to find the centre of the given shapes. Moreover, they were unable to construct the funicular polygon to find the centroid of the irregularly shaped laminar. Approximately 80 per cent of these candidates were unable to calculate the area of the given shapes.

Recommendations

Attention must be given to teaching student about the construction methods used to determine the centre of regular and irregular plane shapes. Students must also be taught how to calculate the area of each shape, using the appropriate formulas. The Advanced Level Technical Drawing Book (3rd edition by E. Jackson) is a good resource that can be used to assist both teachers and students. In addition, it is important for students understand the difference between the funicular (link) polygon method and the graphical integration method when finding the centroid of irregular shapes.

Question 3

This item tested candidate's ability to produce a completed plan, a true shape auxiliary plan and an auxiliary elevation of a hexagonal pyramid with an oblique cut. Candidates were provided with the front view and plan view of a right hexagonal pyramid cut by a plane at 45°. Part (a) of the question tested candidate's ability to produce a completed plan, while Part (b) tested candidates' ability to produce a true shape auxiliary plan. Part (c) tested candidates' ability to produce an auxiliary elevation onto a given plane.

The question was attempted by 89 per cent of candidates. Of significant note is that 50 per cent of candidates offered responses that were limited in scope as such candidates were only able to reproduce the given views. A total of 24 per cent of candidates provided a moderate response to this item. These candidates were able to produce a partially correct plan view. Additionally, candidates who performed within this range were able to produce either the auxiliary plan or the auxiliary elevation. However, these candidates' work did not meet the requirements.

Twelve per cent of candidates offered a fairly good to good response as they were able to produce the correct plan view and the true shape auxiliary plan but were not able to produce the auxiliary elevation. Moreover, had challenges producing an accurate auxiliary elevation.

Approximately three per cent of candidates offered a comprehensive response. These candidates produced a completed plan view, true auxiliary plan and an accurate true shape auxiliary. However approximately 90 per cent of these candidates did not use hatching to represent the cut section of the plan view.

Part (a)

Fifty per cent of the candidates that attempted this part of the item were only able to reproduce the given views and were not able to complete the plan.

Part (b)

Fifty per cent of candidates attempted this part. Thirty-five per cent of those candidates provided a partially accurate response. The remaining 15 per cent of candidates provided an accurate response.

Part (c)

This part was attempted by approximately 10 per cent of candidates. Approximately four per cent provided an accurate response; however the remaining six per cent provided a partially correct response.

Recommendations

In order to improve students' performance, they should be given additional exposure to producing auxiliary views of a range of shapes. They should also be given tasks such as producing plan views of pyramids and emphasis should be placed on ensuring that they can illustrate hatches for solids surfaces.

Students should also be taught that the auxiliary elevation is projected from the plan view and the auxiliary plan is projected from the front view. In addition, they must understand that their page setup should be done correctly and that the correct scale and line-weight should be used when printing their drawings.

Question 4

This item was designed to test candidates' knowledge, application and drawing skills of surface developments as it relates to skewed three-dimensional figures, namely a cone. Approximately 90 per cent of candidates provided a response. The quality of candidates' responses ranged from comprehensive to very limited.

Approximately 17 per cent of candidates performed well. They achieved scores ranging from 10 to 20. These candidates were able to reproduce given figures and generate the respective plan view from the given from elevation. Moreover, such candidates were able to determine the true length of the truncated surface and construct the given development at varied levels of completion.

Approximately 65 per cent of candidates' responses were poor. Candidates who gave poor responses were able to reproduce the given front elevation at varied levels of completion. However, these candidates were unable to determine the true length of the truncated surface and construct the given development at varied levels of completion. Moreover, they were unable to generate the required plan view for the truncated oblique cone. Approximately five per cent of these candidates represented the development of the oblique cone as a cylinder and as such their responses fell into this category.

Part (a)

Approximately 95 per cent of candidates did this part well and were able to reproduce the given figure. However, around 35 per cent had difficulty understanding the line weights, and some also showed a lack of understanding of cones.

Part (b)

Generally, Part (b) was not done well. Over 70 per cent of the candidates who responded were only able to draw the start of the plan but did not follow on to a complete solution of the plan. Approximately 60 to 65 per cent of candidates drew a circle for the truncated surface instead of an ellipse.

Part (c)

Approximately 17 per cent of candidates supplied a fairly good to comprehensive solution which was disappointing given the nature of what was required for the solution. Better understanding of the development of solids is needed especially when true lengths are involved.

Recommendations

The quality of the responses offered by candidates was inadequate. This shows that there is a need to revisit concepts and approaches to these types of solutions in solid geometry. It is recommended that teachers employ the following recommendations in order to improve students' performance.

- More interactive teaching methods such as peer teaching, grouping, etc. are needed to foster students' understanding of the concepts on development of truncated surfaces.
- Additional activities should be used to assist students in becoming more proficient in the development of oblique surfaces.
- Emphasis should be placed enhancing students' understanding of plane and solid geometry to give students a solid foundation in the understanding of these concepts.
- Teachers are encouraged, where necessary and possible, to offer individual support to develop students' ability to complete drawings comprehensively.

Option A — Mechanical Engineering Drawing

Question 5

This item was designed to tests candidates' knowledge, application and drawing skills when reproducing a given crank link mechanism. They were also expected to plot the loci of a given point in the system after one complete revolution of a given crank. The following observations were made.

- In reproducing the given link mechanism, approximately 70 per cent of candidates did not do the following.
  - Outline the given components.
  - Label the given components.
  - Use the appropriate symbols to show direction of movement.
- Thirty-seven per cent of candidates had difficulty applying the principles associated with scribing off the link on the axis of constraint and marking off the points for the locus.
- Approximately 60 per cent of candidates failed to appropriately denote, label and number the moving points to show tracking and direction of movement.
- As it relates to the lines used in the drawings, the following observations were made.
  - Approximately 10 per cent of candidates used coloured lines that did not contrast well with the white background of the paper thus making it visually difficult to adequately assess the details of the drawings.
- Approximately 75 per cent of candidates did not make the best use of construction lines, centre lines and outlines.
- Around 65 per cent of responses were incomplete. This indicated that poor time management might have been a factor.
- The lack of construction details on about five per cent of drawings would suggest that these drawings may have been printed with layers turned off.
- About five percent of the computer-generated responses were not appropriately scaled and printed. As a result, the drawings were extremely small making it very difficult to comprehensively assess the details.
- This was a fairly popular question. Approximately 77 per cent of candidates offered a response.
- Limited or no soft copies were submitted to support the marking of computer-generated scripts.
- Scripts were not properly fastened together. Numerous loose pages were found in the folders.

Overall, about 60 per cent of candidates demonstrated that they had the requisite knowledge and skills. In some instances, entire groups of candidates did not provide a response or the responses given were limited. This may suggest that such candidates lacked exposure to the content area. There were also issues with basic drawing standards such as use of lines, line properties, numbering, labeling, scaling and plotting.

Most candidates offered a response. Of the candidates who responded, 10 per cent of them attempted to reproduce the given link mechanism and 60 per cent attempted to plot the locus.

Of the 179 candidates who offered a response, 39 per cent ranked in the limited to very limited competency level range, 25 per cent ranked in the moderate range, 12 per cent were fairly good, four per cent good and 20 per cent demonstrated a comprehensive mastery of the content.

The following are the main areas of concern identified.

- Reproducing, outlining and labelling the given mechanism
- Application of the principle associated with scribing off the link on the axis of constraint and marking off the points for the locus
- Using or applying appropriate drawing conventions and denotations to loci drawing, for example construction lines, outlines, centre lines, line colour, direction of movement, numberings and labelling of moving points, etc.
- Using CAD tools such as splines
- Scaling of the drawings for plotting

Part (a)

This part required candidates to reproduce the given figure. In reproducing the given link mechanism, about 70 per cent of candidates did not do the following.

- Outline the given components.
- Label the given components.
- Use the appropriate symbols to show direction of movement.

Part (b)

This part required candidates to plot the locus of the Point P which was located at the midpoint of the link BC (which is constrained to reciprocate on a given axis) after one complete revolution of the crank *AB*. The following was observed.

- Sixty 60 per cent of the candidates attempted this section.
- Approximately 37 per cent of candidates had difficulty applying the principles associated with scribing off the link on the axis of constraint and marking off the points for tracing the locus.
- About 60 per cent of candidates failed to appropriately denote, label and number the moving points to show tracking and direction of movement.
- About 30 per cent of candidates failed to accurately position the axis at *C*.
- Around 15 per cent of the candidates had issues using splines.

Recommendations

- Teachers should allot the time recommended in the syllabus to prepare candidates for BMED.
- Students should be taught about a variety of specific conditions as it relates to crank link mechanisms.
- More emphasis should be placed on ensuring that students use basic drawing standards (such as types of lines) so that they can improve in this area.
- Students should be given more exposure to CAD to increase their drawing competency and speed.

Question 6

This item was designed to test candidates' knowledge, application of the knowledge and drawing skills. The item was divided into three parts which tested the candidate's ability to do the following.

- Draw a sectional view of the assembled vice that is cut along the length of the fixed jaw axis.
- Use balloon referencing to label any six parts of the assemble drawing.
- Prepare a parts list for any six parts of the vice.

Overall, 84 per cent of candidates demonstrated that they had knowledge of sectional drawing and were able to identify the correct view to be sectioned. It must be noted that while such candidates were able to identify the correct view to be sectioned, most candidates (more than 50 per cent) were unable to score five out of the 10 marks allotted for drawing standards. The remaining 16 per cent of the candidates did not demonstrate the required level of competency in the fundamental principles of assembly drawings.

Of the 232 candidates, 182 (78 per cent) provided a response while 50 candidates (22 per cent) made no attempt to provide a response.

Part (a)

This part required candidates to draw a sectional view of the assembled vice that was cut along the length of the fixed jaw axis. It tested candidates' knowledge and application of assembly drawing and their ability to correctly section the drawing. While most candidates attempted this part, only two candidates (one per cent of candidates) demonstrated that they had a comprehensive knowledge of how to fully assemble and section the vice. Approximately 33 per cent of candidates proceeded to reproduce the item as given; hence, they scored between zero and three out of the available 10 marks.

Candidates could have improved their performance by accounting for all the parts to be assembled and placing them in the right position, improving on their drawing skills and correctly sectioning the drawing.

Four per cent of candidates performed well (scored 15 to 17 marks). Such candidates failed to fully assemble and section the drawing as required. Approximately two per cent of candidates who attempted the item resorted to free hand sketching and did not use any form of instrument or computer-aided method to complete the drawing.

Part (b)

This part required candidates to use balloon referencing to label any six parts of the assembled drawing. Overall, 36 per cent of candidates who responded to Part (b) demonstrated good knowledge as it relates to engineering standards for balloon referencing. As such, they were able to balloon reference at least four out of the six parts as required. Few candidates, (less than 20 per cent) who attempted Part (b), failed to use the required conventional methods; hence, they lost two marks out of the three marks allotted.

Approximately 18 per cent of candidates did not make any attempt to balloon reference the drawing. Approximately 12 per cent of candidates scored all three marks.

Part (c)

This part required candidates to prepare a parts list for any six parts of the vice. Approximately 75 per cent of candidates attempted to do so. Candidates were expected to provide a parts list that consisted of at least three columns. These columns were expected to be Part Number, Part Name and Quantity. Of the 75 per cent of the candidates who responded, 65 per cent failed to score the full three marks assigned as the drawing standards or application were lacking. Over 50 per cent of candidates scored two to three marks. Few candidates (approximately eight per cent) produced the material list only. This meant that they did not respond to Parts (a) and (b).

Recommendations

- Students should be taught a range of specific conditions related to assembly drawings, including how to produce full sectional drawings.
- Students need to learn how to apply the knowledge learned.
- Students need to improve their basic drawing standards.

Option B — Building Drawing

Question 5

This question tested candidates' knowledge, application and drawing skills. Candidates were given a first-floor plan layout for a structure to produce a sectional view showing the floor slab and supporting beam for a reinforced concrete section. In addition, candidates were required to show all reinforcement and to fully label and dimension the section diagram.

For Part (a), candidates were required to draw a sectional view using the cutting plane line displaying the slab, beams and inclusive of reinforcements. For Part (b), candidates were required to label all reinforcements and show all dimensions.

Approximately 60 per cent of candidates attempted the question. Most candidates (80 per cent) performed moderately to very limited. Such candidates had some challenges understanding what was being asked of them. Approximately 40 per cent of them reproduced the partial plan of the reinforced concrete floor slab provided in the question sheet. Another 10 per cent of candidates reproduced a portion of the partial plan of the reinforced concrete floor slab which was provided in the question sheet. Ten per cent of candidates' responses were not proportional in size and 50 per cent of candidates did not label or dimension their drawing. The remaining 40 per cent of candidates did not attempt the question.

Recommendations

Teachers should spend more time teaching the students how to scale, label, and dimension drawings to maximize their scoring. More emphasis should also be placed on ensuring that students learn how to properly read a plan and identify its integral components within the reinforced concrete floor slab. Students need to improve their basic drawing skills and be efficient in the use of CAD software to produce drawings to meet CXC standards. They should section the given drawing properly to identify the different materials in the reinforcement and to differentiate between them.

Question 6

This item was designed to test candidates' knowledge, application of knowledge and drawing skills. The item was divided into three parts which tested the candidate's ability to do the following.

- Label four main members for a type of tertiary treatment for sewage.
- State the pipe slope appropriate for the pipes that are used to connect the system.
- Show a cross-section of a septic tank.

Overall, approximately 75 per cent of candidates provided a response.

Part (a)

Candidates were required to label four main components of the tertiary treatment system. Most candidates (60 per cent) redrew the provided schematic diagram of the sewer system instead of labelling the specified components as instructed.

Part (b)

Part (b) was a knowledge-based question. However, it was poorly answered. Approximately two per cent of candidates attempted this part and of those, candidates only one per cent provided a correct response. An estimated 90 per cent of candidates were unable to answer the question, while nine per cent gave no response at all.

Part (c)

Approximately 80 per cent of candidates provided a response. Among those who responded, approximately one per cent demonstrated comprehensive knowledge of the subject matter; however, around 15 per cent of candidates showed that they had a good understanding of the concept tested. The remaining 84 per cent of candidates displayed only moderate to limited competency. Candidates who provided a comprehensive to fairly good response had general knowledge of a cross section of a septic tank. Candidates who provided such responses produced their sketch proportionally. Overall, most candidates did not include the necessary reinforcement details and labelling required for the section.

Recommendations

- Teachers need to encourage students to maximize their time when doing the exam. It seemed that many candidates did not read the questions carefully. This led to inefficient use of time and so some candidates did not complete the paper.
- The time recommended in the syllabus needs to be allotted in order for teachers to adequately prepare students for the examination.
- Students need to be effective at printing to scale via PDF to reduce the number of unrecognizable drawings. Too many drawings were not printed correctly.

- Students need to be taught to apply the knowledge they gain. Candidates knew about the septic tank but placed the inlet and the outlet pipes on the same level. Most of them were not knowledgeable about the grade or slope of the sewer pipes.
- Students need to improve their basic drawing standards.
- Students need to be efficient in the use of CAD software so that they can produce drawings as required by syllabus. They should also know how to hatch properly, using the correct conventions to denote different materials.
- Students need to be taught to number their work correctly.