



COUNCIL FOR QUALITY ASSURANCE IN GENERAL AND FURTHER EDUCATION AND TRAINING

***Exemplar Book on Effective Questioning***

***Civil Technology***

**Compiled by the Statistical Information and Research (SIR) Unit**

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## PREFACE

The National Senior Certificate (NSC) examinations are set and moderated in part using tools which specify the types of cognitive demand and the content deemed appropriate for Civil Technology at Grade 12 level. Until recently, the level of cognitive demand made by a question was considered to be the main determinant of the overall level of cognitive challenge of an examination question.

However, during various examination evaluation projects conducted by Umalusi from 2008-2012, evaluators found the need to develop more complex tools to distinguish between questions which were categorised at the same cognitive demand level, but which were not of comparable degrees of difficulty. For many subjects, for each type of cognitive demand a three-level degree of difficulty designation, *easy, moderate and difficult* was developed. Evaluators first decided on the type of cognitive process required to answer a particular examination question, and then decided on the degree of difficulty, *as an attribute of the type of cognitive demand*, of that examination question.

Whilst this practice offered wider options in terms of *easy, moderate and difficult* levels of difficulty for each type of cognitive demand overcame some limitations of a one-dimensional cognitive demand taxonomy, other constraints emerged. Bloom's Taxonomy of Educational Objectives (BTEO) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and the Revised Bloom's Taxonomy are based on the assumption that a cumulative hierarchy exists between the different categories of cognitive demand (Bloom et al., 1956; Bloom, Hastings & Madaus, 1971). The practice of 'levels of difficulty' did not necessarily correspond to a hierarchical model of increasing complexity of cognitive demand. A key problem with using the level of difficulty as an attribute of the type of cognitive demand of examination questions is that, questions recognised at a higher level of cognitive demand are not necessarily categorised as more difficult than other questions categorised at lower levels of cognitive demand. For example, during analyses a basic recognition or recall question could be considered more difficult than an easy evaluation question.

Research further revealed that evaluators often struggled to agree on the classification of questions at so many different levels. The finer categorization for each level of cognitive demand and the process of trying to match questions to pre-set definitions of levels of difficulty made the process of making judgments about cognitive challenge overly procedural. The complex two-dimensional multi-level model also made findings about the cognitive challenge of an examination very difficult for Umalusi Assessment Standards Committee (ASC) to interpret.

In an Umalusi Report, *Developing a Framework for Assessing and Comparing the Cognitive Challenge of Home Language Examinations* (Umalusi, 2012), it was recommended that the type and level of cognitive demand of a question and the level of a question's difficulty should be analysed separately. Further, it was argued that the ability to assess cognitive challenge lay in experts' abilities to recognise subtle interactions and make complicated connections that involved the use of multiple criteria simultaneously. However, the tacit nature of such judgments can make it difficult to generate a common understanding of what constitutes criteria for evaluating the cognitive challenge of examination questions, despite descriptions given in the policy documents of each subject.

The report also suggested that the Umalusi external moderators and evaluators be provided with a framework for thinking about question difficulty which would help them identify where the main sources of difficulty or ease in questions might reside. Such a framework should provide a common language for evaluators and moderators to discuss and justify decisions about question difficulty. It should also be used for building the capacity of novice or less experienced moderators and evaluators to exercise the necessary expert judgments by making them more aware of key aspects to consider in making such judgments.

The revised Umalusi examination moderation and evaluation instruments for each subject draw on research and literature reviews, together with the knowledge gained through the subject workshops. At these workshops, the proposed revisions were discussed with different subject specialists to attain a common understanding of the concepts, tools and framework used; and to test whether the framework

developed for thinking about question difficulty 'works' for different content subjects. Using the same framework to think about question difficulty across subjects will allow for greater comparability of standards across subjects and projects.

An important change that has been made to the revised examination evaluation instrument is that the analysis of *the type of cognitive demand* of a question and analysis of *the level of difficulty* of each question are now treated as two separate judgments involving two different processes. Accordingly, the revised examination evaluation instrument now includes assessment of difficulty *as well as* cognitive demand.

## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Full name</b>
ASC	Assessment Standards Committee
BTEO	Bloom's Taxonomy of Educational Objectives
CAPS	Curriculum Assessment Policy Statement
DBE	Department of Basic Education
FET	Further Education and Training
IEB	Independent Examinations Board
NSC	National Senior Certificate
NQF	National Qualifications Framework
QAA	Quality Assurance of Assessment
QCC	Qualifications, Curriculum and Certification
SIR	Statistical Information and Research

## LIST OF TABLES

TABLE 1: THE TAXONOMY OF COGNITIVE DEMAND LEVELS FOR THE CIVIL TECHNOLOGY NSC EXAMINATIONS	9
TABLE 2: EXAMPLES OF QUESTIONS AT LEVEL 1: LOWER ORDER – KNOWLEDGE	10
TABLE 3: EXAMPLES OF QUESTIONS AT LEVEL 2: MIDDLE ORDER – COMPREHEND AND APPLY	12
TABLE 4: EXAMPLES OF QUESTIONS AT LEVEL 3: HIGHER ORDER – ANALYSE, EVALUATE AND SYNTHETISE	14
TABLE 5: LEVELS OF DIFFICULTY OF EXAMINATION QUESTIONS	24
TABLE 6: FRAMEWORK FOR THINKING ABOUT QUESTION DIFFICULTY	27
TABLE 7: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 1 – EASY	37
TABLE 8: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 2 – MODERATE	39
TABLE 9: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 3 – DIFFICULT	44
TABLE 10: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 4 – VERY DIFFICULT	52

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In addition, Civil Technology subject experts and practitioners are acknowledged for their contribution to the content of this exemplar book. Included in this group are: Umalusi External Moderators and Maintaining Standards Subject Teams and Team Leaders; together with the South African Comprehensive Assessment Institute and the Independent Examinations Board (IEB) Examiners and Internal Moderators.

We also acknowledge the contributions of the members of the Umalusi Quality Assurance of Assessment (QAA); Qualifications, Curriculum and Certification (QCC) and Statistical Information and Research (SIR) Units. We specifically acknowledge the contribution made by the individuals listed below:

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This exemplar book was prepared by Mr Trevor Haas.

## TABLE OF CONTENTS

PREFACE	ii
LIST OF ABBREVIATIONS	v
LIST OF TABLES	vi
ACKNOWLEDGEMENTS	vii
1. INTRODUCTION	1
2. CONTEXT	2
3. PURPOSE OF THE EXEMPLAR BOOK	3
4. MODERATION AND EVALUATION OF ASSESSMENT	4
5. COGNITIVE DEMANDS IN ASSESSMENT	6
6. EXPLANATIONS AND EXAMPLES OF QUESTIONS ASSESSED AT THE DIFFERENT COGNITIVE DEMAND LEVELS IN THE <b>CIVIL TECHNOLOGY</b> TAXONOMY ACCORDING TO CAPS	8
7. ANALYSING THE LEVEL OF DIFFICULTY OF EXAMINATION QUESTIONS	23
7.1 Question difficulty is assessed independently of the type and level of cognitive demand	23
7.2 Question difficulty is assessed at four levels of difficulty	24
7.3 Question difficulty is determined against the assumed capabilities of the ideal 'envisaged Grade 12 Civil Technology NSC examination candidate	25
7.4 Question difficulty is determined using a common framework for thinking about question difficulty	26
7.5 Question difficulty entails distinguishing unintended sources of difficulty or ease from intended sources of difficulty or ease	34
7.6 Question difficulty entails identifying differences in levels of difficulty within a single question	36
8. EXAMPLES OF QUESTIONS ASSESSED AT DIFFERENT LEVELS OF DIFFICULTY	36
9. CONCLUDING REMARKS	57
REFERENCES	58



## 1. INTRODUCTION

The rules of assessment are essentially the same for all types of learning because, to learn is to acquire knowledge or skills, while to assess is to identify the level of knowledge or skill that has been acquired (Fiddler, Marienau & Whitaker, 2006). Nevertheless, the field of assessment in South Africa and elsewhere in the world is fraught with contestation. A review of the research literature on assessment indicates difficulties, misunderstanding and confusion in how terms describing educational measurement concepts, and the relationships between them, are used (Frisbie, 2005).

Umalusi believes that if all role players involved in examination processes can achieve a common understanding of key terms, concepts and processes involved in setting, moderating and evaluating examination papers, much unhappiness can be avoided. This exemplar book presents a particular set of guidelines for both novice and experienced Civil Technology national examiners, internal and external moderators, and evaluators to use in the setting, moderation and evaluation of examinations at the National Senior Certificate (NSC) level.

The remainder of the exemplar book is organised as follows: First, the context in which the exemplar book was developed is described (Part 2), followed by a statement of its purpose (Part 3). Brief summaries of the roles of moderation and evaluation (Part 4) and cognitive demand (Part 5) an assessment. Examination questions selected from the NSC Civil Technology examinations of assessment bodies, the Department of Basic Education (DBE), and/or the Independent Examinations Board (IEB) are used to illustrate how to identify different levels of cognitive demand as required by the Curriculum and Assessment Policy Statement (CAPS) Civil Technology document (Part 6). Part 7 explains the protocols for identifying different levels of difficulty within a question paper. Application of the Umalusi framework for determining difficulty

described in Part 7 is illustrated, with reasons, by another set of questions from a range of Civil Technology examinations (Part 8). Concluding remarks complete the exemplar book (Part 9).

## **2. CONTEXT**

Umalusi has the responsibility to quality assure qualifications, curricula and assessments of National Qualification Framework (NQF) Levels 1 - 5. This is a legal mandate assigned by the *General and Further Education and Training Act (Act 58 of 2001)* and the *National Qualification Framework Act (Act 67 of 2008)*. To operationalize its mandate, Umalusi, amongst other things, conducts research and uses the findings of this research to enhance the quality and standards of curricula and assessments.

Since 2003, Umalusi has conducted several research studies that have investigated examination standards. For example, Umalusi conducted research on the NSC examinations, commonly known as 'Matriculation' or Grade 12, in order to gain an understanding of the standards of the new examinations (first introduced in 2008) relative to those of the previous NATED 550 Senior Certificate examinations (Umalusi, 2009a, 2009b). Research undertaken by Umalusi has assisted the organisation to arrive at a more informed understanding of what is meant by assessing the cognitive challenge of the examinations and of the processes necessary for determining whether the degree of cognitive challenge of examinations is comparable within a subject, across subjects and between years.

Research undertaken by Umalusi has revealed that different groups of examiners, moderators and evaluators do not always interpret cognitive demand in the same way, posing difficulties when comparisons of cognitive challenge were required. The research across all subjects also showed that

using the type and level of cognitive demand of a question *only* as measure for judging the cognitive challenge of a question is problematic because cognitive demand levels on their own do not necessarily distinguish between degrees of difficulty of questions.

The new Umalusi framework for thinking about question difficulty described in this exemplar book is intended to support all key role players in making complex decisions about what makes a particular question challenging for Grade 12 examination candidates.

### **3. THE PURPOSE OF THE EXEMPLAR BOOK**

The overall goal of this exemplar book is to ensure the consistency of standards of examinations across the years in the Further Education and Training (FET) sub-sector and Grade 12, in particular. The specific purpose is to build a shared understanding among teachers, examiners, moderators, evaluators, and other stakeholders, of methods used for determining the type and level of cognitive demand as well as the level of difficulty of examination questions.

Ultimately, the common understanding that this exemplar book seeks to foster is based on the premise that the process of determining the type and level of cognitive demand of questions and that of determining the level of difficulty of examination questions are two separate judgements involving two different processes, both necessary for evaluating the cognitive challenge of examinations. This distinction between cognitive demand and difficulty posed by questions needs to be made in the setting, moderation, evaluation and comparison of Civil Technology examination papers.

The exemplar book includes an explanation of the new Umalusi framework which is intended to provide all role-players in the setting of Civil Technology examinations with a common language for thinking and talking about

question difficulty. The reader of the exemplar book is taken through the process of evaluating examination questions; first in relation to determining the type and level of cognitive demand made by a question, and then in terms of assessing the level of difficulty of a question. This is done by providing examples of a range of questions which make different types of cognitive demands on candidates, and examples of questions at different levels of difficulty.

Each question is accompanied by an explanation of the reasoning behind why it was judged as being of a particular level of cognitive demand or difficulty, and the reasoning behind the judgements made is explained. The examples of examination questions provided were sourced by Civil Technology evaluators from previous DBE and the IEB Civil Technology question papers, pre- and post- the implementation of CAPS during various Umalusi workshops.

This exemplar book is an official document. The process of revising the Umalusi examination evaluation instrument and of developing a framework for thinking about question difficulty for both moderation and evaluation purposes has been a consultative one, with the DBE and the IEB assessment bodies. The new framework for thinking about question difficulty is to be used by Umalusi in the moderation and evaluation of Grade 12 Civil Technology examinations, and by all the assessment bodies in the setting of the question papers, in conjunction with the CAPS documents.

#### **4. MODERATION AND EVALUATION OF ASSESSMENT**

A fundamental requirement, ethically and legally, is that assessments are fair, reliable and valid (American Educational Research Association [AERA], American Psychological Association [APA] and National Council on Measurement in Education [NCME], 1999). Moderation is one of several quality

assurance assessment processes aimed at ensuring that an assessment is fair, reliable and valid (Downing & Haladyna, 2006). Ideally, moderation should be done at all levels of an education system, including the school, district, provincial and national level in all subjects.

The task of Umalusi examination **moderators** is to ensure that the quality and standards of a particular examination are maintained each year. Part of this task is for moderators to alert examiners to details of questions, material and/or any technical aspects in examination question papers that are deemed to be inadequate or problematic and that therefore, challenge the validity of that examination. In order to do this, moderators need to pay attention to a number of issues as they moderate a question paper – these are briefly described below.

Moderation of the technical aspects of examination papers includes checking correct question and/or section numbering, and ensuring that visual texts and/or resource material included in the papers are clear and legible. The clarity of instructions given to candidates, the wording of questions, the appropriateness of the level of language used, and the correct use of terminology need to be interrogated. Moderators are expected to detect question predictability, for example, when the same questions regularly appear in different examinations, and bias in examination papers. The adequacy and accuracy of the marking memorandum (marking guidelines) need to be checked to ensure that they reflect and correspond with the requirements of each question asked in the examination paper being moderated.

In addition, the task of moderators is to check that papers adhere to the overall examination requirements as set out by the relevant assessment body with regard to the format and structure (including the length, type of texts or reading selections prescribed) of the examination. This includes assessing compliance with assessment requirements with regard to ensuring that the

content is examined at an appropriate level and in the relative proportions (weightings) of content and/or skills areas required by the assessment body.

The role of Umalusi examination **evaluators** is to perform analysis of examination papers after they have been set and moderated and approved by the Umalusi moderators. This type of analysis entails applying additional expert judgments to evaluate the quality and standard of finalised examination papers before they are written by candidates in a specific year. However, the overall aim of this evaluation is to judge the comparability of an examination against the previous years' examination papers to ensure that consistent standards are being maintained over the years.

The results of the evaluators' analyses, and moderators' experiences provide the Umalusi Assessment Standards Committee (ASC) with valuable information which is used in the process of statistical moderation of each year's examination results. Therefore, this information forms an important component of essential qualitative data informing the ASC's final decisions in the standardisation of the examinations.

In order for the standardisation process to work effectively, efficiently and fairly, it is important that examiners, moderators and evaluators have a shared understanding of how the standard of an examination paper is assessed, and of the frameworks and main instruments that are used in this process.

## **5. COGNITIVE DEMANDS IN ASSESSMENT**

The *Standards for educational and psychological testing* (AERA, APA, & NCME, 1999) require evidence to support interpretations of test scores with respect to cognitive processes. Therefore, valid, fair and reliable examinations require that the levels of cognitive demand required by examination questions are appropriate and varied (Downing & Haladyna, 2006). Examination papers

should not be dominated by questions that require reproduction of basic information, or replication of basic procedures, and under-represent questions invoking higher level cognitive demands.

Accordingly, the Grade 12 CAPS NSC subject examination specifications state that examination papers should be set in such a way that they reflect proportions of marks for questions at various level of cognitive demand. NSC examination papers are expected to comply with the specified cognitive demand levels and weightings. NSC examiners have to set and NSC internal moderators have to moderate examination papers as reflecting the proportions of marks for questions at different levels of cognitive demand as specified in the documents. Umalusi's external moderators and evaluators are similarly tasked with confirming compliance of the examinations with the CAPS cognitive demand levels and weightings, and Umalusi's revised examination evaluation instruments continue to reflect this requirement.

Despite that, subject experts, examiners, moderators and evaluators are familiar with the levels and explanations of the types of cognitive demand shown in the CAPS documents, Umalusi researchers have noted that individuals do not always interpret and classify the categories of cognitive demand provided in the CAPS the same way. In order to facilitate a common interpretation and classification of the cognitive demands made by questions, the next section of this exemplar book provides a clarification of each cognitive demand level for Civil Technology followed by illustrative examples of examination questions that have been classified at that level of cognitive demand.

## 6. EXPLANATIONS AND EXAMPLES OF QUESTIONS ASSESSED AT THE DIFFERENT COGNITIVE DEMAND LEVELS IN THE CIVIL TECHNOLOGY TAXONOMY ACCORDING TO CAPS

The taxonomies of cognitive demand for each school subject in the CAPS documents are mostly based on the Revised Bloom's Taxonomy (Anderson and Krathwohl, 2001) but resemble the original Bloom's taxonomy in that categories of cognitive demand are arranged along a single continuum. Bloom's Taxonomy of Educational Objectives (BTEO) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and the Revised Bloom's Taxonomy imply that each more advanced or successive category of cognitive demand subsumes all categories below it. The CAPS Taxonomies of Cognitive Demand make a similar assumption (Crowe, 2012).

**Note:**

In classifying the type and level of cognitive demand, each question is classified at the highest level of cognitive process involved. Thus, although a particular question involves recall of knowledge, as well as comprehension and application, the question is classified as an 'analysis' question if that is the highest level of cognitive process involved. If evaluating' is the highest level of cognitive process involved, the question as a whole should be classified as an 'evaluation' question. On the other hand, if one of more sub-sections of the question and the marks allocated for each sub-section can stand independently, then the level of cognitive demand for each sub-section of the question should be analysed separately.

The CAPS documents for many subjects also give examples of descriptive verbs that can be associated with each of the levels of cognitive demand. However, it is important to note that such 'action verbs' can be associated with more than one cognitive level depending on the context of a question.

The Civil Technology CAPS document states that Grade 12 NSC Civil Technology examination papers should examine three levels of cognitive demand (Table 1).



**TABLE 1: THE TAXONOMY OF COGNITIVE DEMAND LEVELS FOR THE CIVIL TECHNOLOGY NSC EXAMINATIONS**

Level of cognitive demand	Type of cognitive demand	Explanation of categorization Questions which require students:	Examples of action words/verbs
Lower order	Knowledge	To <b>recall</b> or <b>recognise explicit</b> information, details, facts, formulas, terms, definitions, procedures, representations <b>from memory or from material provided.</b>	Define, describe, Identify, Name, recognise, select, state, list, recognise
Middle order	Comprehension	To <b>understand</b> the meaning of the learned material, to <b>interpret material, diagrams and drawings</b>	Comprehend, compare, define, describe, distinguish, explain, generalise, illustrate, infer, interpret, match, paraphrase, restate, select, summarize
	Application	To <b>use learned material in new situations</b> to <b>calculate quantities, construct drawings and diagrams</b>	Apply, adapt, compute, discover, draw, gather, graph, modify, operate, prepare, revise, show, solve, survey, use
Higher order	Analysis,	To <b>break down learning material, drawings, and diagrams</b> to <b>understand the content</b> and be able to identify parts.	Analyse, categorise, classify, compare, contrast, decipher, deduce, differentiate, distinguish, explain, generalise, infer, predict, relate, solve
	Synthesis	To <b>put together</b> to produce something new from the <b>translation of words to create a new drawing</b>	Combine, compose, create, depict, design, develop, incorporate, integrate, invent, organise, plan, predict, produce, structure
	Evaluation	To <b>judge the value of the learned material</b> to <b>explain and justify opinions</b>	Appraise, critique, decide, evaluate, judge, justify, recommend


Source: CAPS (DBE, 2011)

To facilitate reading of this section, each of the above cognitive demand levels in the Civil Technology Taxonomy is explained, and the explanation is followed by at least **three** examples of questions from previous Civil Technology NSC examinations classified at each of the levels of cognitive demand shown in Table 1 above. These examples were selected to represent the **best and clearest** examples of each level of cognitive demand that the Civil Technology experts could find. In the discussion below each example question explains the reasoning processes behind the classification of the question at that particular type of cognitive demand (Table 2 to Table 4).

**Note:**

Be mindful that analyses of *the level of cognitive process* of a question and *the level of difficulty* of each question are to be treated as two separate judgments involving two different processes. Therefore, whether the question is easy or difficult should not influence the categorisation of the question in terms of the type and level of cognitive demand. Questions should NOT be categorised as higher order evaluation/synthesis questions because they are difficult questions. Some questions involving the cognitive process of recall or recognition may be more difficult than other recall or recognition questions. Not all comprehension questions are easier than questions involving analysis or synthesis. Some comprehension questions may be very difficult, for example, explanation of complex scientific processes. For these reasons, you need to categorise the level of difficulty of questions separately from identifying the type of cognitive process involved.

**TABLE 2: EXAMPLES OF QUESTIONS AT LEVEL 1: LOWER ORDER – KNOWLEDGE**

<b>Example 1:</b>	
<b>Question 2.4: Exemplar paper 2014, DBE</b>	
FIGURE 2.4 below shows TWO types of steel bars used in reinforced concrete.	
	
<b>FIGURE 2.4</b>	
2.4.1. Identify the steel labelled <b>A</b> and <b>B</b> .	(2)
<b>Memorandum/Marking guidelines</b>	
A – Round bar/mild steel rod ✓	(1)
B – Ribbed bar/high tensile steel ✓	(1)

**Discussion:**

The verb 'identify' suggest that this is a recall type of question. To answer this question candidates have to recognise these types of steel and recall information previously learnt and exposed to in teaching. This is basic content for Grade 12 candidates who should know the different types of steel to be used in the making of formwork. The question is thus classified as a lower order 'knowledge' question.

**Example 2:****Question 2.6: November 2012, DBE**

Describe TWO safety precautions you will take when using electric power tools. (2)

**Memorandum/Marking guidelines**

- Check power tool cable for damage. ✓
- Ensure that the power tool cable lies outside the working area. ✓
- See that the power supply is properly earthed.
- Don't work near water with power tool.
- Moving parts must be kept away from the body.
- Switch off power supply and disconnect the power tool when making adjustments.
- Hold power tool securely and firmly when using it.
- Remove all jewellery and loose clothing.
- Use safety goggles to protect your eyes.
- Report any defects immediately.

**ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER**

(2)

**Discussion:**

The verb 'describe' suggests that this may be a recall type of question because to answer the question candidates have to recall two safety precautions applicable to the use of power tools.

The question tests 'general' knowledge; candidates must recall safety precautions to take when using electric power tools in general. It does not test knowledge of safety precautions to take when using a *specific* electric power tool, or knowledge of safety precaution to take when using portable or stationery power tools. Hence, the question is classified as requiring lower order cognitive process – recall of basic knowledge.

**Example 3:****Question 2.5.3: November 2012, DBE**

Name TWO materials that can be used for the cladding of dry walls. (2)

**Memorandum/Marking guidelines**

- Gypsum board ✓
- Chipboard/Veneered board ✓
- Supawood/Medium-density fibre board
- Hardboard/Masonite
- Plywood

- Shutter board
- SA Pine

(2)

**ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER**

**Discussion:**

The verb 'name' suggests that this may be a recall type of question. Candidates need to recall real-life situations where dry walls are used and use this information to answer this question.

**TABLE 3: EXAMPLES OF QUESTIONS AT LEVEL 2: MIDDLE ORDER – COMPREHEND AND APPLY**

**Example 1:**

**Question 2.3: November 2011, DBE**

Compare dry wall construction with brick wall construction. Redraw the table below and **tabulate** your answer.

No	DRY WALL CONSTRUCTION	BRICK WALL CONSTRUCTION
1		
2		
3		

(6)

**Memorandum/Marking guidelines**

No	DRY WALL CONSTRUCTION	BRICK WALL CONSTRUCTION
1	The erection of dry walls is a dry process. ✓	Wet material such as mortar is to be used to join bricks. ✓
2	The partitions are adaptable and can be fitted in awkward places. ✓	It is time consuming to cut bricks to accommodate awkward angles in a wall. ✓
3	Materials are easily portable/need less storage space than brickwork. ✓	Materials require a lot of storage space. ✓
4	Partition stud/steel rail/standard partitions weigh less	Material is heavy

**ANY THREE IN EACH COLUMN OR ANY OTHER ACCEPTABLE ANSWER IF THE COMPARISON RELATES**

(6)

**Discussion:**

The **action word** 'compare' indicates that this is probably a medium order question. To compare dry wall construction with brick wall construction, candidates first **recall knowledge about wall constructions** that are used in the built environment. They then have to **apply this knowledge to distinguish between the two types** of construction methods mentioned in the question and list similarities and differences between the two concepts.

To compare dry wall construction and brick wall construction, they need to have a good **comprehension of the nature and function of both types of walls.**

The question requires candidates to **recall knowledge of the two types of walls** and **demonstrate their understanding of the concepts** by **applying their knowledge** and is thus classified as a middle order question.

**Example 2:**

**Question 2.4: November 2012, DBE**

FIGURE 2.4 below shows different readings taken with a dumpy level. Use the given readings and **calculate:**

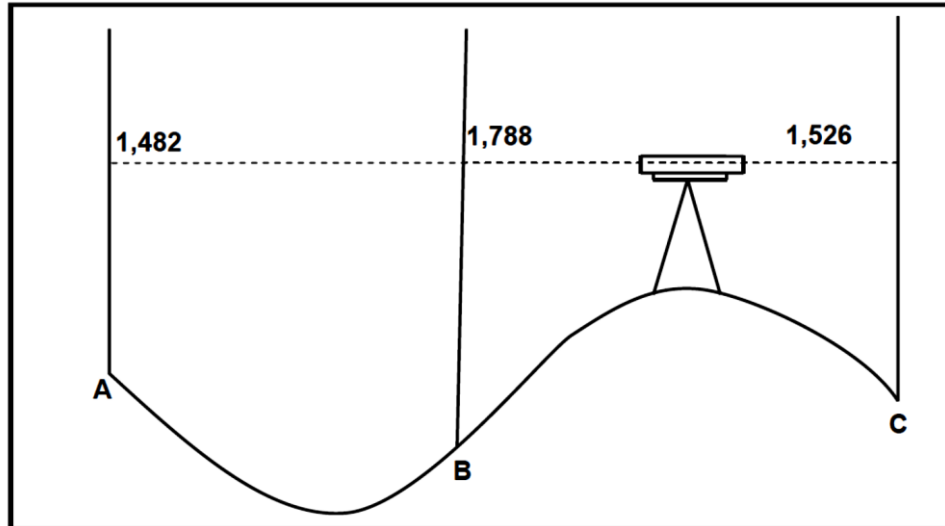


FIGURE 2.4

- 2.4.1 The difference between levelling staff A and levelling staff B. (2)  
 2.4.2 The difference in height between levelling staff B and levelling staff C. (2)  
 2.4.3 What is the reading at B called? (1)  
 2.4.4 Is there a rise or fall from B to C.? (1)

**Memorandum/Marking guidelines**

- 2.4.1  
 $1,788 \text{ m} - 1,482 \text{ m} \checkmark$  or  $1,482 \text{ m} - 1,788 \text{ m}$   
 $= 0,306 \text{ m} \checkmark$   $= -0,306 \text{ m}$  (2)
- 2.4.2  
 $1,788 \text{ m} - 1,526 \text{ m} \checkmark$  or  $1,526 \text{ m} - 1,788 \text{ m}$   
 $= 0,262 \text{ m} \checkmark$   $= -0,262 \text{ m}$  (2)
- 2.4.3  
 Intermediate sight  $\checkmark$  (1)
- 2.4.4  
 Rise  $\checkmark$  (1)

**Discussion:**

Candidates have to engage in middle order cognitive processes to answer all of these questions. All four questions require candidates to interpret and understand the drawing provided in order to perform the necessary calculations. To answer the questions, they have to recognise that the vertical lines at A, B and C represent the different positions of the levelling staff. They must also understand that the measurements, 1,482, 1,788 and 1,526 represent the height measured on the rods at pegs A, B and C. They have to **recognise and understand** from the diagram that the measurements were taken with the dumpy level only in one position.

In question 2.4.1 candidates must **calculate the difference in height** between A and B. In order to calculate the difference in height, they must apply the principle of subtracting the intermediate sight/fore sight from the back sight.

In question 2.4.2 candidates have to *calculate* the difference in height between B and C. Again, they must apply the principle of subtracting the intermediate sight/fore sight from the back sight.

In question 2.4.3 the key phrase “what is” implies that the question is a lower order question. To answer the question candidates have to identify the name of the type of reading at B. However, answering the question also requires thorough comprehension of the levelling book. This factor raises the question to a middle order question.

In question 2.4.4 the key phrase “is there” implies that candidates need **to explain, determine or describe**. Answering the question entails using the information from the drawing to determine if there is a rise or fall between B and C. Candidates must apply their knowledge of the use of the dumpy level to perform the required calculations for the completion of the levelling book. They can also use/apply the calculated difference between B and C in question 2.4.2 to decide if there is a rise or a fall between the two indicated positions of the levelling staff. These factors require middle order thinking skills.

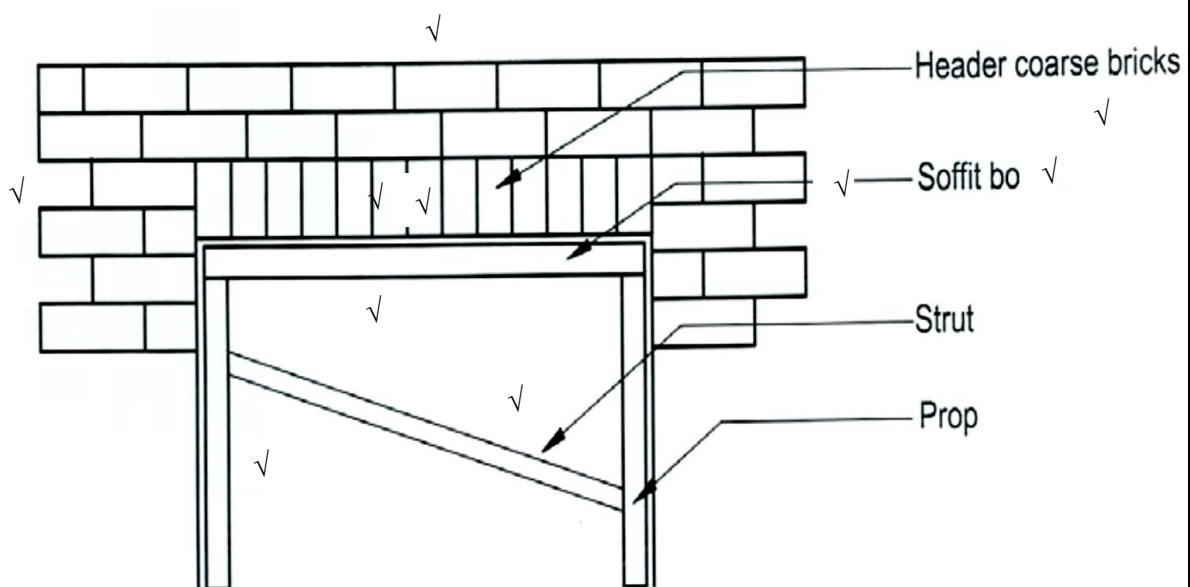
**Example 3:**

**Question 1.4: November 2011, DBE**

With the aid drawing instruments, make a neat sketch of a flat gauged arch in a face-brick wall showing the following details:

- Bricks for flat gauged arch in header course.
- Two courses in stretcher bond above the header course.
- All surrounding brickwork in stretcher bond. Show only two courses of brickwork below the header course.
- Soffit board to support the header course.
- Props to hold the soffit board in position.
- A strut between the props to prevent the props from collapsing.
- Show any TWO labels on your drawing. (10)

**Memorandum/Marking guidelines**



ASSESSMENT CRITERIA	MARK	LM
Flat gauged arch brick header course	2	
Two courses of brickwork above arch	1	
Surrounding brickwork in stretcher bond	2	
Soffit board	1	
Props	1	
Strut	1	
Any two labels	2	
<b>Total:</b>	<b>10</b>	

**LM = Learner's mark**

**Discussion:**

The action word 'draw' in this question indicates that it is a middle order question; candidates must *draw* a flat gauged arch. To answer the question, candidates have to draw a neat sketch using drawing instruments. They have to apply their knowledge of arches. They have to recall the relevant building components and show an understanding of components used in the built environment and apply this knowledge in the drawing of the flat gauged arch. They have to apply their knowledge of building components and draw a sketch that is in good proportion.

The question does not indicate that the drawing must be done in the ANSWER BOOK which means that specific drawing skills using drawing instruments must be applied. The fact that no measurements are given in this question means that candidates are required to estimate the correct proportions of parts in the drawing. Answering the question also requires reading with insight. Candidates need to recognise that the sequence of the bulleted statements and drawing a free hand sketch before attempting to draw the actual drawing with drawing instruments will help them with the actual drawing of the solution.

In completing the task, candidates have to apply their knowledge of the construction of a flat gauge arch as well as the different courses that can be used to build arches. Showing the required details entails having a good understanding of the shapes and sizes of all the building components. The labelling requires candidates to correctly identify two parts. The printing of labels on the diagram requires lower order thinking skills.

**TABLE 4: EXAMPLES OF QUESTIONS AT LEVEL 3: HIGHER ORDER – ANALYSE, EVALUATE AND SYNTHETIZE**

<b>Example 1:</b>
<b><u>Question 2.3: November 2010, DBE</u></b>
Distinguish between a <i>short-bored (auger) pile</i> and a <i>precast concrete pile</i> . (4)
<b><u>Memorandum/Marking guidelines</u></b>



**Short bored pile:**

- Holes are drilled into the ground. ✓
- These holes are filled with concrete by gravitational force. ✓

**Precast concrete pile:**

- Precast concrete piles are percussion driven. ✓
- It is driven into the ground by means of a mechanical drop action hammer. ✓

**ANY OTHER ACCEPTABLE ANSWER****(4)****Discussion:**

The action verb 'distinguish' in this question indicates that it is a higher order question. To answer the question candidates have to differentiate between the two concepts in the building environment, i.e. a short-bored (auger) pile and a precast concrete pile and be able to make informed decisions around its use. They have to apply and break down the relevant knowledge on piling, analyse and explain the differentiating features between the two types of piles.

**Example 2:****Question 6: November 2008, DBE**

In your school, there is a need to build a storeroom for Civil Technology equipment. As an aspiring draughtsman, you are tasked to produce the working drawings for a two-roomed storeroom building.

Notes:

- The building should have one external entrance as a roll-up door. This door must be fitted in room 2.
- The entrance to the building must be facing south. A ramp must be built to allow access for a vehicle.
- Access from one room to the other is through an inter-leading door built into a half-brick wall.
- The structure is built with 220 mm x 110 mm x 75 mm face bricks.
- The roof must be a lean-to roof sloping downward from south to north.
- Parapet walls three courses above the roof.
- The window in room 1 must be 1500 mm x 900 mm and must face south.
- The window in room 2 must be 2000 mm x 600 mm and must face east.

**Specifications:**

- Internal measurements: Room 1 – 4000 mm x 3000 mm  
Room 2 - 4000 mm x 5500 mm
- Door opening 1: 2400 mm x 2100 mm  
Door opening 2: 810 mm x 2100 mm
- Windows: W1 - 1500 mm x 900 mm (facing south)  
W2 - 2000 mm x 600 mm
- Roof: Pitch 15° - the highest side of the roof must be on the same side as the entrance door.  
Corrugated iron sheeting must be used for the roof covering.  
Rafters - 114 mm x 38 mm  
Purlins - 50 mm x 76 mm

Wall plate – 114 mm x 38 mm

100 mm diameter gutter and down pipes

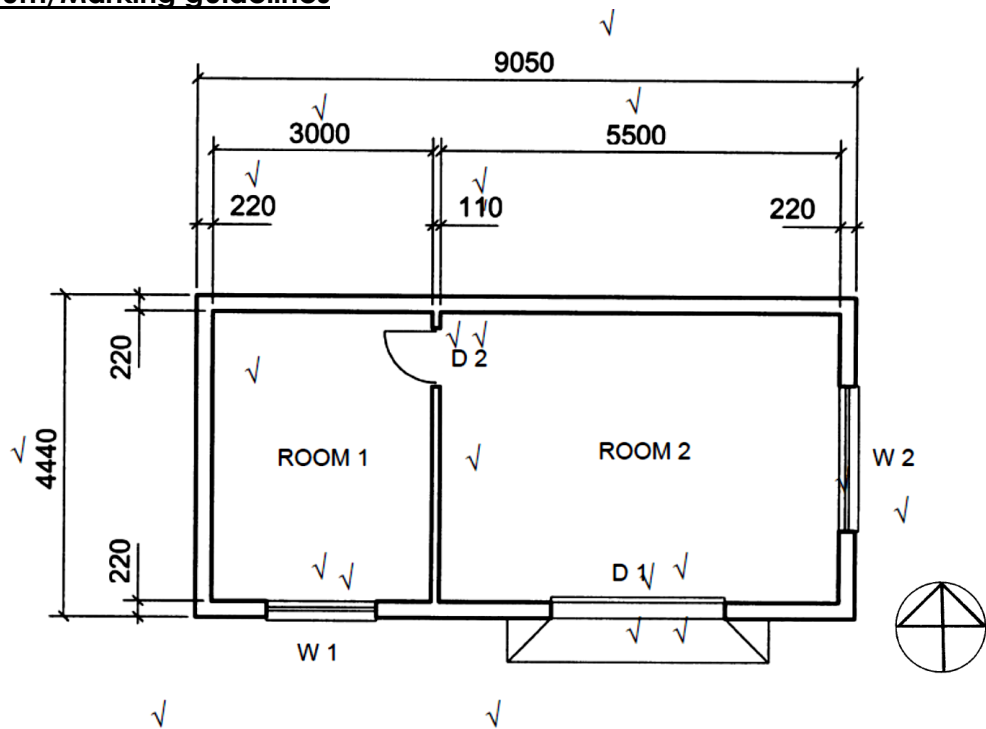
6.1 Using a scale of 1:100 design and draw the floor plan of the storeroom on ANSWER SHEET 6.1. Dimension your drawing. (20)

6.2 Draw to a scale 1:100 the south elevation of the storeroom on ANSWER SHEET 6.2. (10)

6.3 Draw to a scale 1:50 a vertical section through the building as seen from the western side on ANSWER SHEET 6.3.

Show only the roof construction and top of the external walls. (10)

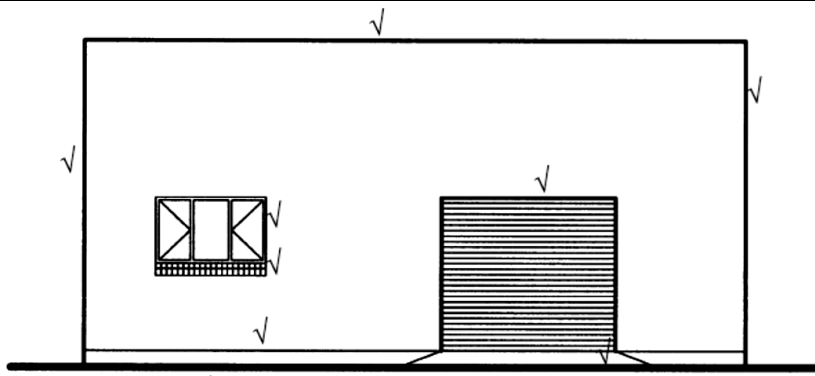
**Memorandum/Marking guidelines**



**FLOOR PLAN SCALE 1:100 (20)**

ASSESSMENT CRITERIA	MARKS	LM
External walls	1	
Internal wall	1	
Windows	4	
Roll-up garage door	2	
Ramp	2	
Interior door	2	
Dimensions	6	
Title and scale	2	
<b>Total:</b>	<b>20</b>	

**LM = Learner's marks**



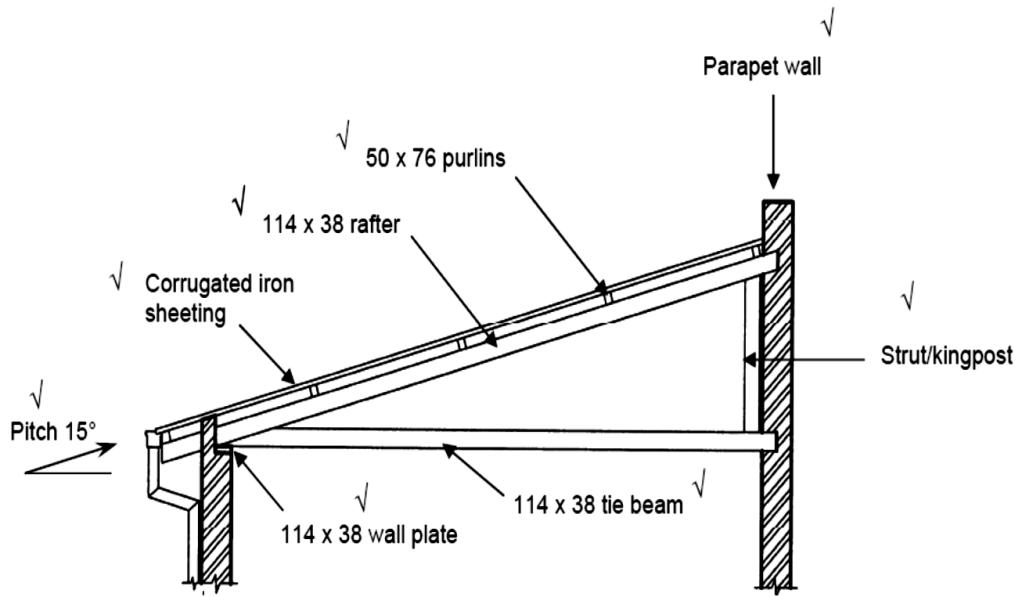
✓  
**SOUTH ELEVATION**

✓  
**SCALE 1:100**

(10)

ASSESSMENT CRITERIA	MARKS	LM
Height of walls	2	
Length of wall	1	
Windows	1	
Window sill	1	
Floor line	1	
Ramp	1	
Roll-up garage door	1	
Title and scale	2	
<b>Total:</b>	<b>10</b>	

**ANSWER SHEET 6.3**



Correctness of the drawing = 1 ✓

Correct scale = 1 ✓

**(NOT TO SCALE)**

**(10)**

ASSESSMENT CRITERIA	MARKS	LM
Correctness of:		
Drawing	1	
Pitch of roof	1	
Parapet	1	
Corrugated iron sheeting	1	
Beam	1	
Strut/Kingpost	1	
Rafter	1	
Purlins	1	
Wall plate	1	
Correct application of scale	1	
<b>Total:</b>	<b>10</b>	

**Discussion:**

The action words in question 6.1 design and draw indicate that this question is a higher order question; candidates must use a scale of 1:100 to design and draw a floor plan.

In Questions 6.2 and 6.3, the action word 'draw' indicates that it is higher order questions. In Question 6.2 candidates must draw the south elevation, and in Question 6.3 they must draw the vertical section showing only the roof construction and top of external walls as seen from the western side.

To answer the question, as a whole, candidates have to design and draw three elevations of the working drawings for a two-roomed storeroom to be used for Civil Technology equipment. Specifications relevant to the design are provided and must be used to compile the different elevations. Candidates are required to use the given specifications to design and draw a completed floor plan, south elevation and vertical section through the building. The cognitive processes involved are knowledge, comprehension, application, analysis and synthesis.

Candidates have to recall their knowledge of floor plans, elevations and sectional views through a building. They have to interpret the notes and specifications, analyse the information provided and show an understanding of which aspects are needed to construct and complete the elevations. They have to design, apply their knowledge of constructing working drawings, drawing techniques and given specifications of the different elevations. Candidates are expected to convert the written information into working drawings.

**Example 3:**

**Question 4: November 2010, DBE**

You are an architect and have advised a client to use aluminium windows and doors to develop a site at the coast.

Give three reasons why you have recommended the use of this material. (3)

**Memorandum/Marking guidelines**

- No maintenance is required. ✓
- Corrosion/rust free. ✓
- It is strong and elastic. ✓
- It is durable.
- It is aesthetically appealing.

**OR ANY OTHER ACCEPTABLE ANSWER (3)**

**Discussion:**

In this question, the verb 'give' implies the action word 'justify'; candidates must justify their recommendation for using aluminium as a material for windows and doors at the coast by giving reasons. To answer the question, candidates have to evaluate the properties of aluminium. Candidates have to assess the suitability of aluminium by applying their knowledge to the particular scenario. They need to explain why it is recommended for doors and windows to be used at the coast. These processes make the question a higher order one.

To accomplish the goal of discriminating between high achievers, those performing very poorly, and all candidates in between, examiners need to vary the challenge of examination questions. Until recently, the assumption has been that 'alignment' with the allocated percentage of marks for questions at the required cognitive demand levels meant that sufficient examination questions were relatively easy; moderately challenging; and difficult for candidates to answer.

However, research and candidate performance both indicate that a range of factors other than type of cognitive demand contributes to the cognitive challenge of question. Such factors include the level of content knowledge required, the language used in the question, and the complexity or number of concepts tested. In other words, cognitive demand levels on their own do not necessarily distinguish between degrees of difficulty of questions.

This research helps, to some extent, explain why, despite that some NSC examination papers have complied with the specified cognitive demand weightings stipulated in the policy, they have not adequately distinguished between candidates with a range of academic abilities in particular between higher ability candidates. As a result, examiners, moderators and evaluators are now required to assess the difficulty of level of each examination question in addition to judging its cognitive demand.

Section 7 below explains the new protocol introduced by Umalusi for analysing examination question difficulty.

## 7. ANALYSING THE LEVEL OF DIFFICULTY OF EXAMINATION QUESTIONS

When analysing the level of difficulty of each examination question, there are six important protocols to note. These are:

1. Question difficulty is **assessed independently** of the type and level of **cognitive demand**.
2. Question difficulty is assessed against **four levels of difficulty**.
3. Question difficulty is determined against the assumed capabilities of the **ideal 'envisaged'** Grade 12 Civil Technology NSC examination **candidate**.
4. Question difficulty is determined using **a common framework** for thinking about question difficulty.
5. Question difficulty entails **distinguishing unintended sources of difficulty** or ease **from intended sources of difficulty** or ease.
6. Question difficulty entails identifying **differences** in levels of difficulty **within a single question**.

Each of the above protocols is individually explained and discussed below.

### 7.1 Question difficulty is assessed independently of the type and level of cognitive demand

As emphasised earlier in this exemplar book, the revised Umalusi NSC examination evaluation instruments separate the analysis of the type of cognitive demand of a question from the analysis of the level of difficulty of each examination question. Cognitive demand describes the *type of cognitive process* that is required to answer a question, and this does not necessarily equate or align with the *level of difficulty* of other aspects of a question, such as the difficulty of the content knowledge that is being assessed. For example, a recall question can ask a candidate to recall very complex and abstract scientific content. The question would be categorised as Level 1 in terms of the cognitive demand taxonomy but may be rated as 'difficult' (Level 3 Table 5 below).

**Note:**

Cognitive demand is just one of the features of a question that can influence your comparative judgments of question difficulty. The type and level of cognitive process involved in answering a question does not necessarily determine how difficult the question would be for candidates. Not all evaluation/synthesis /analysis questions are more difficult than questions involving lower-order processes such as comprehension or application.

## 7.2 Question difficulty is assessed at four levels of difficulty

The revised Umalusi NSC examination evaluation instruments require evaluators to exercise expert judgments about whether each examination question is 'Easy', 'Moderately challenging', 'Difficult' or 'Very difficult' for the envisaged Grade 12 learner to answer. Descriptions of these categories of difficulty are shown in Table 5.

**TABLE 5: LEVELS OF DIFFICULTY OF EXAMINATION QUESTIONS**

1	2	3	4
<b>Easy</b> for the envisaged Grade 12 student to answer.	<b>Moderately challenging</b> for the envisaged Grade 12 student to answer.	<b>Difficult</b> for the envisaged Grade 12 student to answer.	<b>Very difficult</b> for the envisaged Grade 12 student to answer.  The skills and knowledge required to answer the question allow for the top students ( <i>extremely</i> high-achieving/ability students) to be discriminated from other high achieving/ability students).



**Note:**

The fourth level, 'very difficult' has been included in the levels of difficulty of examination questions to ensure that there are sufficient questions that discriminate well amongst higher ability candidates.

### **7.3 Question difficulty is determined against the assumed capabilities of the ideal 'envisaged' Grade 12 Civil Technology NSC examination candidate**

The revised Umalusi NSC examination evaluation instruments require evaluators to exercise expert judgments about whether each examination question is 'Easy', 'Moderately challenging', 'Difficult' or 'Very difficult' for the '**envisaged**' Grade 12 learner to answer (Table 5). In other words, assessment of question difficulty is linked to a particular target student within the population of NSC candidates, that is, the Grade 12 candidate of average intelligence or ability.

The Grade 12 learners that you may have taught over the course of your career cannot be used as a benchmark of the 'envisaged' candidate as we cannot know whether their abilities fall too high, or too low on the entire spectrum of all Grade 12 Civil Technology candidates in South Africa. The revised Umalusi NSC examination evaluation instruments thus emphasise that, when rating the level of the difficulty of a particular question, your conception of the 'envisaged' candidate needs to be representative of the entire population of candidates for all schools in the country, in other words, of the overall Grade 12 population.

Most importantly, the conception of this 'envisaged' candidate is a learner who has been taught the whole curriculum adequately by a teacher who is qualified to teach the subject, in a functioning school. There are many disparities in the South African education system that can lead to very large differences in the implementation of the curriculum. Thus this 'envisaged' learner is not a typical South African Grade 12 learner – it is an intellectual construct (an imagined person) whom you need to imagine when judging the level of difficulty of a question. This ideal 'envisaged' Grade 12 learner is an

aspirational ideal of where we would like all Civil Technology learners in South Africa to be.

**Note:**

The concept of the **envisaged Grade 12 candidate** is that of an imaginary learner who has the following features:

- a. Is of average intelligence or ability.
- b. Has been taught by a competent teacher.
- c. Has been exposed to the entire examinable curriculum.

This envisaged learner represents an imaginary person who occupies the middle ground of ability and approaches questions *having had all the necessary schooling*.

#### **7.4 Question difficulty is determined using a common framework for thinking about question difficulty**

Examiners, moderators and evaluators **in all subjects** are now provided with a common framework for thinking about question difficulty to use when identifying sources of difficulty or ease in each question, and to provide their reasons for the level of difficulty they select for each examination question.

The framework described in detail below provides the main sources of difficulty or 'ease' inherent in questions. The four sources of difficulty, which must be considered when thinking about the level of difficulty of examination questions in this framework, are as follows:

1. '**Content difficulty**' refers to the difficulty inherent in the subject matter and/or concept/s assessed.
2. '**Stimulus difficulty**' refers to the difficulty that candidates confront when they attempt to read and understand the question and its source material. The demands of the reading required to answer a question thus form an important element of 'stimulus difficulty'.
3. '**Task difficulty**' refers to the difficulty that candidates confront when they try to formulate or produce an answer. The level of cognitive demand of a question forms an element of 'Task difficulty', as does the demand of the written text or representations that learners are required to produce for their response.
4. '**Expected response difficulty**' refers to difficulty imposed by examiners in a marking guideline, scoring rubric or memorandum. For example, mark

allocations affect the amount and level of answers students are expected to write.

This framework derived from Leong (2006) was chosen because it allows the person making judgments about question difficulty to grapple with nuances and with making connections. The underlying assumption is that judgment of question difficulty is influenced by the interaction and overlap of different aspects of the four main sources of difficulty. Whilst one of the above four sources of difficulty may be more pronounced in a specific question, the other three sources may also be evident. Furthermore, not all four sources of difficulty need to be present for a question to be rated as difficult.

The four-category conceptual framework is part of the required Umalusi examination evaluation instruments. Each category or source of difficulty in this framework is described and explained in detail below (Table 9). Please read the entire table very carefully.

**TABLE 6: FRAMEWORK FOR THINKING ABOUT QUESTION DIFFICULTY**

<b>CONTENT/CONCEPT DIFFICULTY</b>
<b>Content/concept difficulty</b> indexes the difficulty in the <b>subject matter, topic or conceptual knowledge</b> assessed or required. In this judgment of the item/question, difficulty exists in the <b>academic and conceptual demands</b> that questions make and/or the <b>grade level</b> boundaries of the various 'elements' of domain/subject knowledge (topics, facts, concepts, principles and procedures associated with the subject).
<b>For example:</b>
Questions that assess ' <b>advanced content</b> ', that is, subject knowledge that is considered to be in advance of the grade level curriculum, are <i>likely</i> to be difficult or very difficult for most candidates. Questions that assess subject knowledge which forms part of the core curriculum for the grade are <i>likely</i> to be moderately difficult for most candidates. Questions that assess ' <b>basic content</b> ' or subject knowledge candidates would have learnt at lower grade levels, and which would be familiar to them are <i>unlikely</i> to pose too much of a challenge to most candidates.

Questions that require general everyday knowledge or knowledge of 'real life' experiences are *often* easier than those that test more **specialized** school **knowledge**. Questions involving only concrete objects, phenomena, or processes are *usually* easier than those that involve more **abstract constructs, ideas, processes or modes**.

Questions which test learners' understanding of theoretical or **de-contextualised issues or topics**, rather than their knowledge of specific examples or contextualised topics or issues *tend* to be more difficult. Questions involving familiar, contemporary/current contexts or events are *usually* easier than those that are more **abstract** or involve **'imagined' events** (e.g. past/future events) or **contexts** that are **distant from learners' experiences**.

Content difficulty may also be varied by changing **the number of knowledge elements or operations assessed**. *Generally*, the difficulty of a question increases with the number of knowledge elements or operations assessed. Questions that assess learners on two or more knowledge elements or operations are *usually* (but not always) more difficult than those that assess a single knowledge element or operation.

Assessing learners on **a combination of knowledge elements or operations that are seldom combined** *usually* increases the level of difficulty.

#### EXAMPLES OF INVALID OR UNINTENDED SOURCE OF CONTENT DIFFICULTY

- Testing obscure or unimportant concepts or facts that are not mentioned in the curriculum, or which are unimportant to the curriculum learning objectives.
- Testing very advanced concepts or operation that candidates are extremely unlikely to have had opportunities to learn.

#### STIMULUS DIFFICULTY

**Stimulus difficulty** refers to the difficulty of the linguistic **features of the question** (**linguistic** complexity) and the challenge that candidates face when they attempt to read, interpret and understand the words and phrases in the question AND when they attempt to read and understand the **information or 'text' or source material (diagrams, tables and graphs, pictures, cartoons, passages, etc.) that accompanies the question**.

#### For example:

Questions that contain words and phrases that require only simple and straightforward comprehension are *usually* easier than those that require the candidate to understand **subject specific phraseology and terminology** (e.g. idiomatic or grammatical language not usually encountered in everyday language), or that require more technical comprehension and specialised

command of words and language (e.g. everyday words involving different meanings within the context of the subject).

Questions that contain information that is 'tailored' to an expected response, that is, questions that contain no irrelevant or distracting information, are *generally* easier than those that require candidates to select relevant and appropriate information or **unpack a large amount of information** for their response. A question **set in a very rich context** can increase question difficulty. For example, learners may find it difficult to select the correct operation when, for example, a mathematics or accountancy question is set in a context-rich context.

Although the level of difficulty in examinations is *usually* revealed most clearly through the questions, text complexity or the degree of **challenge or complexity in written or graphic texts** (such as a graph, table, picture, cartoon, etc.) that learners are required to read and interpret in order to respond can increase the level of difficulty. Questions that depend on reading and selecting content from a text can be more challenging than questions that do not **depend on actually reading the accompanying text** because they test reading comprehension skills as well as subject knowledge. Questions that require candidates to **read a lot** can be more challenging than those that require limited reading. Questions that tell learners where in the text to look for relevant information are *usually* easier than those where **learners are not told where to look**.

The level of difficulty *may* increase if texts set, and reading passages or other **source material** used are challenging for the grade level, and make **high reading demands** on learners at the grade level. Predictors of textual difficulty include:

- **semantic content** - for example, if vocabulary and words used are typically outside the reading vocabulary of Grade 12 learners, 'texts' (passage, cartoon, diagram, table, etc.) are *usually* more difficult. 'Texts' are *generally* easier if words or images are made accessible by using semantic/context, syntactic/structural or graphophonic/visual cues.
- **syntactic or organisational structure** - for example, sentence structure and length. For example, if learners are likely to be *familiar with the structure* of the 'text' or resource, for example, from reading newspapers or magazines, etc. 'texts' are *usually* easier than when the structure is unfamiliar.
- **literary techniques** - for example, abstractness of ideas and imagery - and **background knowledge required**, for example, to make sense of allusions.
- if the **context** is **unfamiliar** or remote, or if candidates do not have or are **not provided with access to the context** which informs a text (source material, passage, diagram, table, etc.) they are expected to read, and which informs the question they are supposed to answer and the answer they are expected to write, then constructing a response is *likely* to be more difficult than when the context is provided or familiar.

Questions which require learners to **cross-reference different sources** are *usually* more difficult than those which deal with one source at a time.

Another factor in stimulus difficulty is presentation and visual appearance. For example, type face and size, use of headings, and other types of textual organisers etc. can aid **'readability'** and make it easier for learners to interpret the meaning of a question.

## EXAMPLES OF INVALID OR UNINTENDED SOURCES OF STIMULUS DIFFICULTY

- Meaning of words unclear or unknown.
- Difficult or impossible to work out what the question is asking.
- Questions which are ambiguous.
- Grammatical errors in the question that could cause misunderstanding.
- Inaccuracy or inconsistency of information or data given.
- Insufficient information provided.
- Unclear resource (badly drawn or printed diagram, inappropriate graph, unconventional table).
- Dense presentation (too many important points packed in a certain part of the stimulus).

## TASK DIFFICULTY

**Task difficulty** refers to the **difficulty that candidates confront when they try to formulate or produce an answer.**

### For example:

In most questions, to generate a response, candidates have to work through the steps of a solution. *Generally*, questions that **require more steps in a solution** are more difficult than those that require fewer steps. Questions involving only one or two steps in the solution are *generally* easier than those where several operations required for a solution.

Task difficulty may also be mediated by the **amount of guidance present in the question**. Although question format is not necessarily a factor and difficult questions can have a short or simple format, questions that provide guided steps or cues (e.g. a clear and detailed framework for answering) are *generally* easier than those that are more open ended and require candidates to form or tailor their **own response strategy** or argument, work out the steps **and maintain the strategy for answering** the question by themselves. A high degree of prompting (a high degree of prompted recall, for example) *tends* to reduce difficulty level.

Questions that test specific knowledge are *usually* less difficult than **multi-step, multiple-concept or operation questions**.

A question that requires the candidate to **use a high level of appropriate subject specific, scientific or specialised terminology in their response** *tends* to be more difficult than one which does not.

A question requiring candidates to **create a complex abstract (symbolic or graphic) representation** is *usually* more challenging than a question requiring candidates to create a concrete representation.

A question requiring writing a one-word answer, a phrase, or a simple sentence is *often* easier to write than **responses that require more complex sentences, a paragraph or a full essay or composition**.

Narrative or descriptive writing, for example where the focus is on recounting or ordering a sequence of events chronologically, is *usually* easier than **writing discursively (argumentatively or analytically)** where ideas need to be developed and ordered logically. Some questions reflect task difficulty simply by '**creating the space**' for **A-grade candidates** to demonstrate genuine insight, original thought or good argumentation, and to write succinctly and coherently about their knowledge.

Another element is the **complexity in structure of the required response**. When simple connections between ideas or operations are expected in a response, the question is *generally* easier to answer than a question in which the significance of the relations between the parts and the whole is expected to be discussed in a response. In other words, a question in which an unstructured response is expected is *generally* easier than a question in which **a relational response** is required. A response which involves **combining or linking a number of complex ideas or operations** is *usually* more difficult than a response where there is no need to combine or link ideas or operations.

On the other hand, questions which require continuous prose or extended writing *may* also be easier to answer correctly or to get marks for than questions that require no writing at all or single letter answer (such as multiple choice), or a brief response of one or two words or short phrase/s because they **test very specific knowledge**.

The **cognitive demand** or **thinking processes** required form an aspect of task difficulty. Some questions test thinking ability, and learners' capacity to deal with ideas, etc. Questions that assess inferential comprehension or application of knowledge, or that require learners to take ideas from one context and use it in another, for example, *tend* to be more difficult than questions that assess recognition or retrieval of basic information. On the other hand, questions requiring recall of knowledge are *usually* more difficult than questions that require simple recognition processes.

When the **resources for answering** the question are included in the examination paper, then the task is *usually* easier than when candidates have to **use and select their own internal resources** (for example, their own knowledge of the subject) or transform information to answer the question.

Questions that require learners to take or **transfer** ideas, **skills or knowledge from one context/subject area and use them in another** *tend* to be more difficult.

#### EXAMPLES OF INVALID OR UNINTENDED SOURCES OF TASK DIFFICULTY

- Level of detail required in an answer is unclear.
- Context is unrelated to or uncharacteristic of the task than candidates have to do.
- Details of a context distract candidates from recalling or using the right bits of their knowledge.
- Question is unanswerable.
- Illogical order or sequence of parts of the questions.
- Interference from a previous question.
- Insufficient space (or time) allocated for responding.
- Question predictability or task familiarity. If the same question regularly appears in examination papers or has been provided to schools as exemplars,

learners are likely to have had prior exposure, and practised and rehearsed answers in class (for example, when the same language set works are prescribed each year).

- Questions which involve potential follow-on errors from answers to previous questions.

## EXPECTED RESPONSE DIFFICULTY

**Expected response difficulty** refers to difficulty imposed by examiners in a **mark scheme and memorandum**. This location of difficulty is more applicable to 'constructed' response questions, as opposed to 'selected' response questions (such as multiple choice, matching/true-false).

### For example:

When examiners expect few or no details in a response, the question is *generally* easier than one where the mark scheme implies that **a lot of details are expected**.

A further aspect of expected response difficulty is the clarity of the **allocation of marks**. Questions are *generally* easier when the allocation of marks is explicit, straight-forward or logical (i.e. 3 marks for listing 3 points) than when the **mark allocation is indeterminate or implicit** (e.g. when candidates need all 3 points for one full mark or 20 marks for a discussion of a concept, without any indication of how much, and what to write in a response). This aspect affects difficulty because candidates who are unclear about the mark expectations in a response may not produce sufficient amount of answers in their response that will earn the marks that befit their ability.

Some questions are more difficult/easy to mark accurately than others. Questions that are **harder to mark and score objectively** are *generally* more difficult for candidates than questions that require simple marking or scoring strategies on the part of markers. For example, recognition and recall questions are *usually* easier to test and mark objectively because they usually require the use of matching and/or simple scanning strategies on the part of markers. More complex questions requiring analysis (breaking down a passage or material into its component parts), evaluation (making judgments, for example, about the worth of material or text, or about solutions to a problem), synthesis (bringing together parts or elements to form a whole), and creativity (presenting own ideas or original thoughts) are *generally* harder to mark/score objectively. The best way to test for analysis, evaluation, synthesis and creativity is usually through extended writing. Such extended writing *generally* requires the use of more cognitively demanding *marking* strategies such as interpreting and evaluating the logic of what the candidate has written.

Questions where **a wide range of alternative answers or response/s** is possible or where the correct answer may be arrived at through different strategies *tend* to be more difficult. On the other hand, questions may be so open-ended that learners will get marks even if they engage with the task very superficially.



#### EXAMPLES OF INVALID OR UNINTENDED SOURCES OF EXPECTED RESPONSE DIFFICULTY

- Mark allocation is unclear or illogical. The weighting of marks is important in questions that comprise more than one component when components vary in levels of difficulty. Learners may be able to get the same marks for answering easy component/s of the item as other learners are awarded for answering the more difficult components.
- Mark scheme and questions are incongruent. For example, there is no clear correlation between the mark indicated on the question paper and the mark allocation of the memorandum.
- Question asked is not the one that examiners want candidates to answer. Memorandum spells out expectation to a slightly different question, not the actual question.
- Impossible for candidate to work out from the question what the answer to the question is (answer is indeterminable).
- Wrong answer provided in memorandum.
- Alternative correct answers from those provided or spelt out in the memorandum are also plausible.
- The question is 'open' but the memo has a closed response. Memo allows no leeway for markers to interpret answers and give credit where due.

The framework described above does not provide you with explicit links between the different sources of difficulty, or show relationships and overlaps between the different categories and concepts in the framework. This is because it is impossible to set prescribed rules or pre-determined combinations of categories and concepts used for making judgments about the source of difficulty in a particular examination question.

The intention behind the framework is to allow you to exercise your sense of judgment as an expert. The complexity of your judgment lies in your ability as an expert to recognise subtle interactions and identify links between different categories of a question's difficulty or ease. For example, a question that tests specific knowledge of your subject can actually be more difficult than a multi-step question because it requires candidates to explain a highly abstract concept, or very complex content. In other words, although questions that test specific knowledge are *usually* less difficult than multiple-concept or operation questions, the level of difficulty of the content knowledge required to answer a question can make the question more difficult than a multi-step or multi-operation question.

Not all one-word response questions can automatically be assumed to be easy. For example, multiple-choice questions are not automatically easy because a choice of responses is provided – some can be difficult. As an expert in your subject, you need to make these types of judgments about each question.

**Note:**

It is very important that you become extremely familiar with the framework explained in Table 6, and with each category or source of difficulty provided (i.e. content difficulty, task difficulty, stimulus difficulty, and expected response difficulty). You need to understand the examples of questions which illustrate each of the four levels (Table 7 to Table 10). This framework is intended to assist you in discussing and justifying your decisions regarding the difficulty level ratings of questions. You are expected to **refer to all four categories or sources of difficulty** in justifying your decisions.

When considering question difficulty ask:

- How difficult is the **knowledge** (content, concepts or procedures) that is being assessed for the envisaged Grade 12 candidate? (*Content difficulty*)
- How difficult is it for the envisaged Grade 12 candidate to formulate the answer to the question? In considering this source of difficulty, you should **take into account the type of cognitive demand** made by the task. (*Task difficulty*)
- How difficult is it for the envisaged Grade 12 candidate to **understand the question and the source material** that need to be read to answer the particular question? (*Stimulus difficulty*)
- What does the **marking memorandum and mark scheme** show about the difficulty of the question? (*Expected response difficulty*)

## **7.5 Question difficulty entails distinguishing unintended sources of difficulty or ease from intended sources of difficulty or ease**

Close inspection of the framework for thinking about question difficulty (Section 7.4, Table 6) above, shows that, for each general category or source of difficulty, the framework makes a distinction between 'valid' or intended, and 'invalid' or unintended sources of question difficulty or ease. Therefore, defining question difficulty entails identifying whether sources of difficulty or ease in a question were intended or unintended by examiners. Included in Table 6 are examples of unintended sources of difficulty or ease for each of the four categories.

Valid difficulty or 'easiness' in a question has its source in the requirements of the question, and is **intended** by the examiner (Ahmed and Pollit, 1999). Invalid sources of difficulty or 'easiness' refer to those features of question difficulty or 'easiness' that were **not intended** by the examiner. Such unintended 'mistakes' or omissions in questions can prevent the question from assessing what the examiner intended, and are likely to prevent candidates from demonstrating their true ability or competence, and can result in a question being easier or more difficult than the examiner intended.

For example, grammatical errors in a question that could cause misunderstanding for candidates are unintended sources of question difficulty because the difficulty in answering the question could lie in the faulty formulation of the question, rather than in the intrinsic difficulty of the question itself (for example, because of stimulus difficulty). Candidates "may misunderstand the question and therefore not be able to demonstrate what they know" (Ahmed and Pollit, 1999, p.2). Another example is question predictability (when the same questions regularly appear in examination papers or textbooks) because familiarity can make a question which was intended to be difficult, less challenging for examination candidates.

Detecting unintended sources of difficulty or ease in examinations is largely the task of moderators. Nevertheless, evaluators also need to be vigilant about detecting sources which could influence or alter the intended level of question difficulty that moderators may have overlooked.

**Note:**

When judging question difficulty, you should distinguish **unintended sources of question difficulty or ease** from those sources that are intended, thus ensuring that examinations have a range of levels of difficulty. The framework for thinking about question difficulty allows you to systematically identify technical and other problems in each question. Examples of problems might be: unclear instructions, poor phrasing of questions, the provision of inaccurate and insufficient information, unclear or confusing visual sources or illustrations, incorrect use of terminology, inaccurate or inadequate answers in the marking memorandum, and question predictability. You should **not** rate a question as difficult/easy if the source of difficulty/ease lies in the 'faultiness' of the question or memorandum. Instead, as moderators and evaluators, you need to alert examiners to unintended sources of difficulty/ease so that they can improve questions and remedy errors or sources of confusion before candidates write the examination.

### **7.6 Question difficulty entails identifying differences in levels of difficulty within a single question**

An examination question can incorporate more than one level of difficulty if it has subsections. It is important that the components of such questions are 'broken down' into their individual levels of difficulty.

**Note:**

Each subsection of a question should be analysed separately so that the percentage of marks allocated at each level of difficulty and the weighting for each level of difficulty can be ascertained as accurately as possible for that question.

## **8. EXAMPLES OF QUESTIONS AT DIFFERENT LEVELS OF DIFFICULTY**

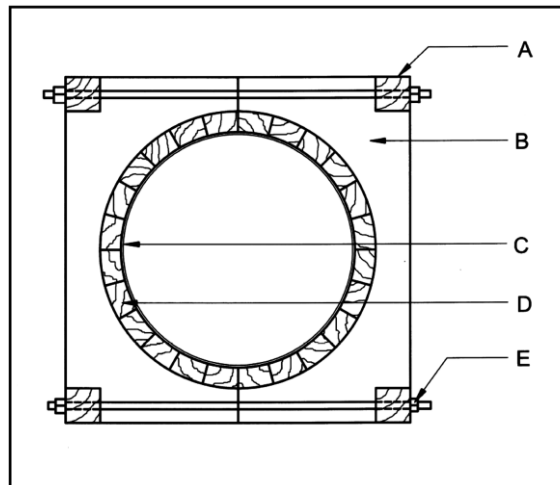
This section provides at least **three** examples of questions from previous Civil Technology NSC examinations (Table 7 to Table 10) categorised at each of the four levels of difficulty described in Section 7 (Table 5) above. These examples were selected to represent the **best and clearest** examples of each level of difficulty that the Civil Technology experts could find. The discussion below each example question tries to explain the reasoning behind the judgments

made about the categorisation of the question at that particular level of difficulty.

**TABLE 7: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 1 – EASY**

<b>Example 1:</b>
<b><u>Question 2.8: November 2011, DBE:</u></b>
Name TWO types of scaffolds that can be used on building sites and describe ONE place where you will use each of these types of scaffolds respectively. (4)
<b><u>Memorandum/Marking guidelines</u></b>
<ul style="list-style-type: none"> <li>• Pipe scaffolds ✓ – builder/carpenter/glazier. ✓</li> <li>• Putlog scaffolds ✓ – high rise buildings. ✓</li> <li>• Movable/Mobile platforms – electrician/painter/repairing of ceiling boards.</li> <li>• Independent scaffolds – bricklaying/building gable ends.</li> <li>• Trestles – building walls of low height/installing gutters/painting.</li> <li>• Dependent scaffold – depends on building for support/allow for more working space on scaffold.</li> <li>• Truss-out scaffold – depends on building for support/allow for more working space on scaffold.</li> </ul>
<b>ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER (4)</b>
<b><u>Discussion:</u></b>
<p>This question is categorised as easy because:</p> <ul style="list-style-type: none"> <li>• Answering the question requires basic knowledge of an easy concept 'scaffolding'. Grade 12 candidates should all have learnt about seven types of scaffolds in class. They would all also have seen scaffolds used on building sites in their everyday life (content).</li> <li>• The question itself is straightforward and easy to read and understand; the requirements are very explicit (stimulus.)</li> <li>• All candidates need to do to answer the question is recall the names of two out of a possible seven types of scaffolds used in the building industry and identify one place where each of these scaffolds would be used. This second part of the task is also easy as there are a variety of places candidates can choose from. They have to recall what they have learnt in class and can also draw on what they have observed in real life (task)</li> <li>• The marking scheme is very straightforward; candidates get two marks for correctly writing down the name of each type of scaffold and two marks for writing one place for each of the two types of scaffold. The answers are short and simple (expected response).</li> </ul>
<b>Example 2:</b>
<b><u>Question 2.8: November 2010, DBE</u></b>
Figure 2.8 below shows the formwork for a round concrete column. Write the letters A to E in your ANSWER BOOK and next to them the names of the parts. Choose the answer from the list below.

Lining materials; bolt and nut; metal collar/ribs; vertical clamps; lagging; props; clamps



**FIGURE 2.8**

**Memorandum/Marking guidelines**

- A. Vertical clamps ✓
- B. Metal collars/rib ✓
- C. Lining material ✓
- D. Laggings ✓
- E. Bolt and nut/nut ✓ (5)

**Discussion:**

This question is classified as easy because:

- The topic 'formwork for a round concrete column' should be familiar to and easy for Grade 12 candidates. The parts provided in the box should all be familiar to them, except perhaps for the metal collar/ribs (content).
- The wording of the question itself is simple and straight forward which makes it easy to comprehend. The diagram of the round concrete column is a simple illustration which contains very little detail and is thus easily understood. The size of the diagram also makes it very easy to read (stimulus).
- The task is a labelling one where candidates have to match the letters on the diagram with terms provided in a box. Candidates have to select five correct terms from a list of seven possible answers. They do not have to unravel a large amount of information to answer the question. They simply have to remember what they should have learnt in class about the formwork for a round concrete column (task).
- Candidates only have to write down the five letters and next to it the selected response from the list for five marks (expected response).

**Example 3:**

**Question 1.4: November 2009, DBE**

Hand tools are an asset to any tradesman. Assume you are a tradesman. Explain how you will take care of your hand tools to ensure that they serve you well in the years to come.

(5)

**Memorandum/Marking guidelines**

- Wet hands can cause ferrous metals to rust, try to make contact with these parts as little as possible. ✓
- Remove rust from tools with steel wool only and thereafter apply a thin layer of oil or wax over it. ✓
- Check tools regularly for defects. ✓
- Avoid stacking tools on top of each other. ✓
- Tools must not be left lying around, they must be returned to its proper storage place. ✓
- Cutting tools must be sharp and its edges protected with a covering. ✓

**ANY FIVE OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS****(5)****Discussion:**

This question is classified as easy because:

- The question tests basic knowledge regarding the care of hand tools. The requirements are very explicit. Grade 12 candidates are on a daily basis exposed to the care of hand tools in the Civil Technology workshop, which will make it very easy to answer this question (content).
- The introductory statement and question are both very easy to read and understand and there are no complicated or subject specific terms used. The context is an everyday one in the Civil Technology workshop. The *stimulus* material does not specify a specific hand tool which makes the question fairly open-ended (stimulus).
- Although the action verb in the question is 'explain', in reality this question simply requires recall, understanding and application of basic knowledge related to the care of hand tools (i.e. middle order cognitive processes). Answering the question requires writing a few simple sentences. The envisaged Grade 12 candidate should experience no or very little difficulty in formulating a response although the omission of the number of aspects in the question may pose a slight challenge for some candidates (task).
- The question does not specify that candidates must explain FIVE aspects of how to care for your hand tools. However, the examination instructions clearly stated that the mark allocation should be used as a guide as to the length of the *expected response*. The mark allocation of 5 marks thus provides a clear signal to candidates that, in their response, they have to provide at least five aspects (*expected response*).

**TABLE 8: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 2 – MODERATE****Example 1:****Question 2.7: November 2011, DBE**

Discuss the factors that must be considered after ready-mixed concrete has been ordered to ensure that the placing of the concrete is carried out efficiently and timeously. (3)

**Memorandum/Marking guidelines**

- The workmen to place/cast the concrete must be ready. ✓

- Ramps to take concrete to another level if necessary must be erected before the concrete arrives. ✓
- The formwork to cast the concrete must be ready. ✓
- All tools and equipment to cast /place the concrete must be clean and ready.
- The rate of casting/placing and compacting the concrete must be done in such a way so as not to waste time.

**ANY THREE OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER**

(3)

**Discussion:**

This question is moderately difficult because:

- To answer the question the envisaged Grade 12 candidate must know the difference methods to produce concrete. It should also be familiar with the procedures of placing the concrete. To discuss ready-mixed concrete candidates must have an appropriate understanding of the concept of ready-mixed concrete. The question only tests the procedure of placing ready-mixed concrete which makes it a moderately difficult question because candidates do not have much exposure to the placing of ready-mixed concrete as in the case of handmade concrete (content).
- The question does not ask for factors related to concrete in general, but specifically about factors that ensure that the placing of ready mix concrete is carried out 'efficiently' and 'timeously'. Candidates need to understand the meaning of these two terms (efficiently and timeously) to answer the question. This makes the question moderately challenging for the envisaged Grade 12 candidates (stimulus).
- To answer the question, candidates need to recall and differentiate between their knowledge of the efficient and timeous placing of handmade and machine-made concrete to discuss the placing of ready-mixed concrete. Candidates needed to distinguish between the different types of concrete to discuss the efficient and timeously placing of ready-mixed concrete which makes the *task* moderately difficulty (task).
- The question does not specify the number of factors that need to be discussed, but the examination instructions clearly state that the mark allocation should be used as a guide as for the *expected response*. The allocation of 3 marks signals to candidates that they must provide three factors for three marks (expected response).

**Example 2:**

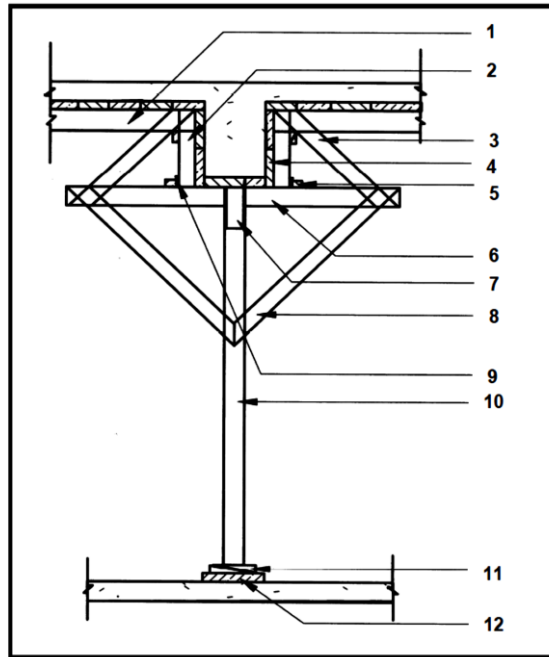
**Question 2.1.2: November 2009, DBE:**

2.1 During the construction of multi-storey buildings, formwork is used extensively.

2.1.2

FIGURE 2.9 below shows the sketch of a formwork of a beam with an attached floor. Write down the numbers 1 to 12 in your ANSWER BOOK and choose the correct name for each item from the list below the drawing. Write the name next to the corresponding number in your ANSWER BOOK.





**FIGURE 2.9**

Joist or bearer	cleats	head tree or head	fish plate/cleat	sole plate or sole piece	folding wedge	strut or stay	wedge	board shuttering	strut or brace	post or prop	fixing plate or kicker	(12)
-----------------	--------	-------------------	------------------	--------------------------	---------------	---------------	-------	------------------	----------------	--------------	------------------------	------

**Memorandum/Marking guidelines**

1. Joist / Bearer ✓
2. Cleats ✓
3. Stay / Strut ✓
4. Board shuttering ✓
5. Fixing plate/Kicker ✓
6. Head/Head tree ✓
7. Fish plate/Cleat ✓
8. Strut / Brace ✓
9. Wedges ✓
10. Post/Prop ✓
11. Folding wedges ✓
12. Sole plate/Sole piece ✓

(12)

**Discussion:**

This question is classified as moderately difficult because:

- To answer this question candidates need a good understanding of what is meant by a beam with an attached floor. Answering the question requires a visualisation and technical comprehension of the construction of formwork for a beam with an attached floor as well as the terms and concepts involved. Candidates need to analyse the diagram, identify a part and choose from the list the correct name of the part. This makes the content and concepts tested moderately difficult for the envisaged Grade 12 candidate (content).
- The given information and subject terminology in the written text and diagram poses several challenges for the envisaged Grade 12 candidate. First, candidates have to think, about and unpack the instructions in the question. Second, the diagram in the source material where a beam with an attached floor is shown, contains a lot of detail. Third, some of the technical

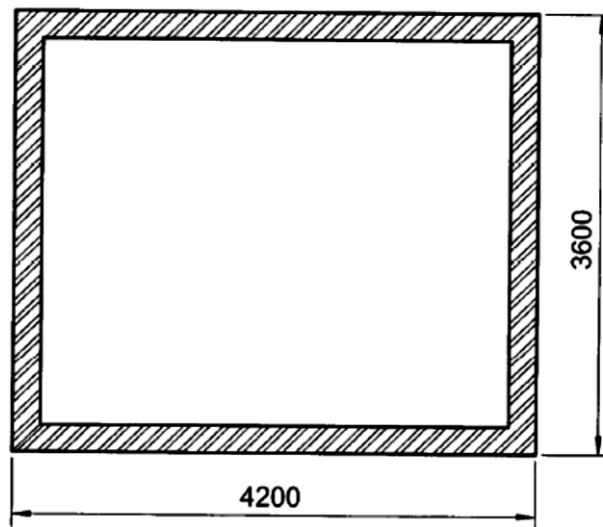
terms given in the selection of answers box show alternative names for parts. Candidates have to realise that a strut, stay and brace are the same and perform the same function. Providing alternatives such as strut or stay and brace or strut makes the reading and selection of answers from the list more challenging for candidates (stimulus).

- The *task* entails identifying twelve parts in the diagram provided. Candidates first have to analyse and interpret the diagram and choose possible answers given in order to identify and choose the correct answer. Although they are provided with twelve possible answers from which the twelve correct answers must be selected (making the task moderately difficult rather than very difficult), looking through the whole list of possible answers is fairly time consuming. Candidates also have to 'unravel' more information to work out each answer which makes the task moderately difficult rather than easy (task).
- The *expected response* is relatively straightforward. Candidates simply have to write the numbers 1 – 12 and copy the correct terms next to the corresponding number. Twelve marks are allocated for twelve responses. The number of responses required also makes the question moderately difficult, rather than difficult for the envisaged Grade 12 candidate (expected response).

**Example 3:**

**Question 4.8: November 2008, DBE**

Figure 4.8 shows the plan view of the outside walls of a strong room in your Civil Technology centre.



**FIGURE 4.8**

4.8.1 Use ANSWER SHEET 4.8 and calculate the quantity of tiles you would require to tile the floor. The size of the tiles is 300 mm x 300 mm. (5)

**ANSWER SHEET 4.8**

A	B	C	D


**Memorandum/Marking guidelines**

A	B	C	D
			<b>Internal measurements of long walls</b>
			= 4 200 mm – 2(220) mm
			= 3 760 mm
			<b>Internal measurements of short walls</b>
			= 3 600 mm – 2(220) mm
			= 3 160 mm
			<b>Area of floor</b>
1/	3,76 ✓		
	3,16 ✓	11,88 m <sup>2</sup> ✓	
			<b>Area of one tile</b>
1/	0,3		
	0,3	0,09 m <sup>2</sup> ✓	
			<b>Quantity of tiles required</b>
			= 11,88 m <sup>2</sup> ÷ 0,09 m <sup>2</sup>
			= 132 tiles needed ✓

(5)

**Discussion:**

This question is classified as moderately difficult because:

- To answer the question candidates must know the different stages needed to get to the answer because no sub-questions that could have assisted the candidate are given. They should know that in order to calculate the number of tiles required the inside lengths followed by the areas of the floor and one tile must be calculated. The number of tiles can only then be calculated. The knowledge to answer these mathematical questions on the dimension paper makes this a moderately difficult question for the envisaged Grade 12 candidate (content).

- The ANSWER SHEET consists of a dimension paper which candidates have to use to perform their calculations. Candidates need to know and understand the purpose of columns A, B, C and D on the dimension paper. The envisaged Grade 12 candidate will experience challenges to construct their answers on a blank dimension paper. Candidates also have to interpret and analyse the diagram to realise that the inside lengths are required and not the outside lengths. Answering the questions is moderately challenging because the envisaged Grade 12 candidate must apply their knowledge on how to use a dimension paper as well as the theoretical knowledge to calculate the quantity of tiles needed (stimulus).
- Candidates must show that they understand, and can apply their knowledge to calculate quantities and how to use the dimension paper to do the calculations. Candidates must recall how they have answered these types of calculations in class, understand how to use the given information and apply prior knowledge to calculate the number of tiles. The omission of information on the dimension paper or sub questions to guide the candidates in answering this question makes this a moderately difficult question (task).
- The responses from candidates should indicate that they know how to structure their answers according to the methods of completing a dimension paper. The allocation of marks is clear and will ease the marking of the answers. The 5 marks for the different calculations indicate that the level of difficulty of the expected response is moderate (expected response).

**TABLE 9: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 3 – DIFFICULT**

**Example 1:**

**Question 2.2: November 2013, DBE**

FIGURE 2.2 below shows the installation of a rib-and-block suspended concrete floor.



**FIGURE 2.2**

2.2.1 When installation shown in FIGURE 2.2 has been complete, explain the follow-up processes to complete the floor. (4)

**Memorandum/Marking guidelines**

- Place conduit for services. ✓
- Place spacer blocks between reinforcement and block. ✓
- Place reinforcing/welded mesh on top of the blocks. ✓
- Cast concrete. ✓
- Compact concrete by hand or vibrator.
- Render floor with screed.

**ANY FOUR OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER (4)**

**Discussion:**

The question is difficult for the envisaged Grade 12 candidates because:

- Grade 12 candidates are unlikely to have been exposed to these types of floors in real-life which makes the content abstract and highly technical. The envisaged Grade 12 candidate should rely on their theoretical knowledge of rib and block floors to answer the question. Candidates must analyse the picture thoroughly in order to determine the follow-up processes (content).
- The picture of the rib-and-block suspended concrete floor being installed is very different from the kinds of pictures and diagrams that candidates are accustomed to seeing in their textbooks. For example, there are no labels provided to assist them in understanding the installation. The only textual information provided about the figure is that it 'shows the installation of a rib-and-block suspended concrete floor'. Candidates have to rely on their own interpretation of the material provided. The question requires the knowledge and understanding of the concepts 'rib-and-block' and 'suspended concrete floors'. The envisaged Grade 12 candidate would not be very familiar with either of these concepts which are relatively abstract and difficult for them to understand (stimulus).
- In answering this question, candidates first have to interpret the fairly abstract image of a rib-and-block suspended concrete floor being installed. They have to make sense of the picture. Explaining the follow-up processes to complete the floor requires complex reasoning and thinking because candidates must deduce from the picture the follow-up processes and construct a well-articulated response (task).
- Question 2.2.1 requires that candidates write text using their own words to explain the follow up process for four marks. Four marks are allocated for a response that needs to be well-articulated one sentence short answers to make this a difficult question (expected response).

**Example 2:**

**Question 3.2: November 2013, DBE**

3.2.2. On ANSWER SHEET 3.2 design a sewerage system and draw the sewerage plan for the building. Take into consideration all regulations and design principles of a good sewerage system. Indicate the following on your drawing:

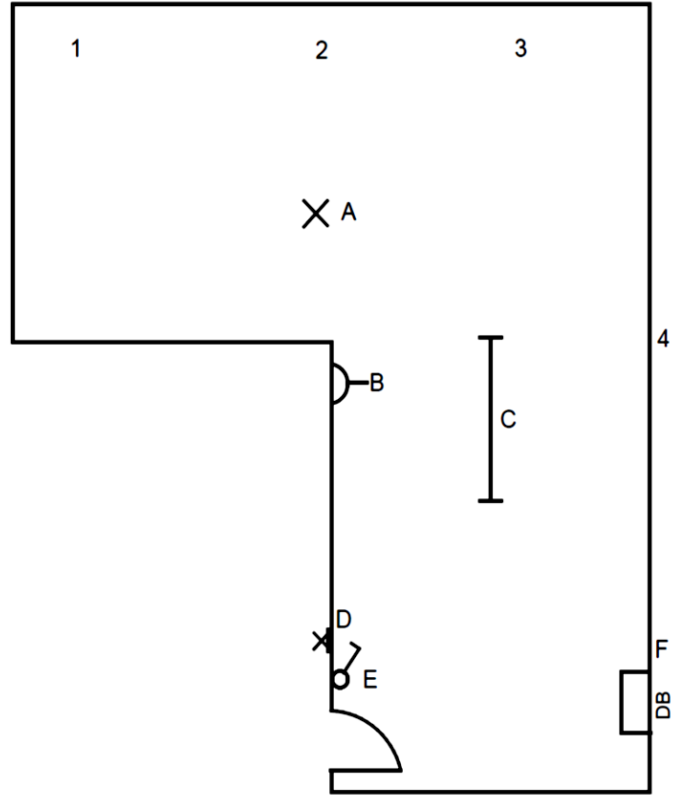
- A manhole near the connection to the conservancy tank.
- A gulley at the sink.
- A vent pipe at the water closet.
- A rodding eye at the highest point of the sewerage system and another one where there is a change in direction.
- Inspection eyes where branch and main pipes meet.
- Indicate all sewerage abbreviations where applicable. (11)

CENTRE NUMBER:

EXAMINATION NUMBER:

**QUESTION 3.2**

**ANSWER SHEET 3.2**



**FIGURE 3.2**

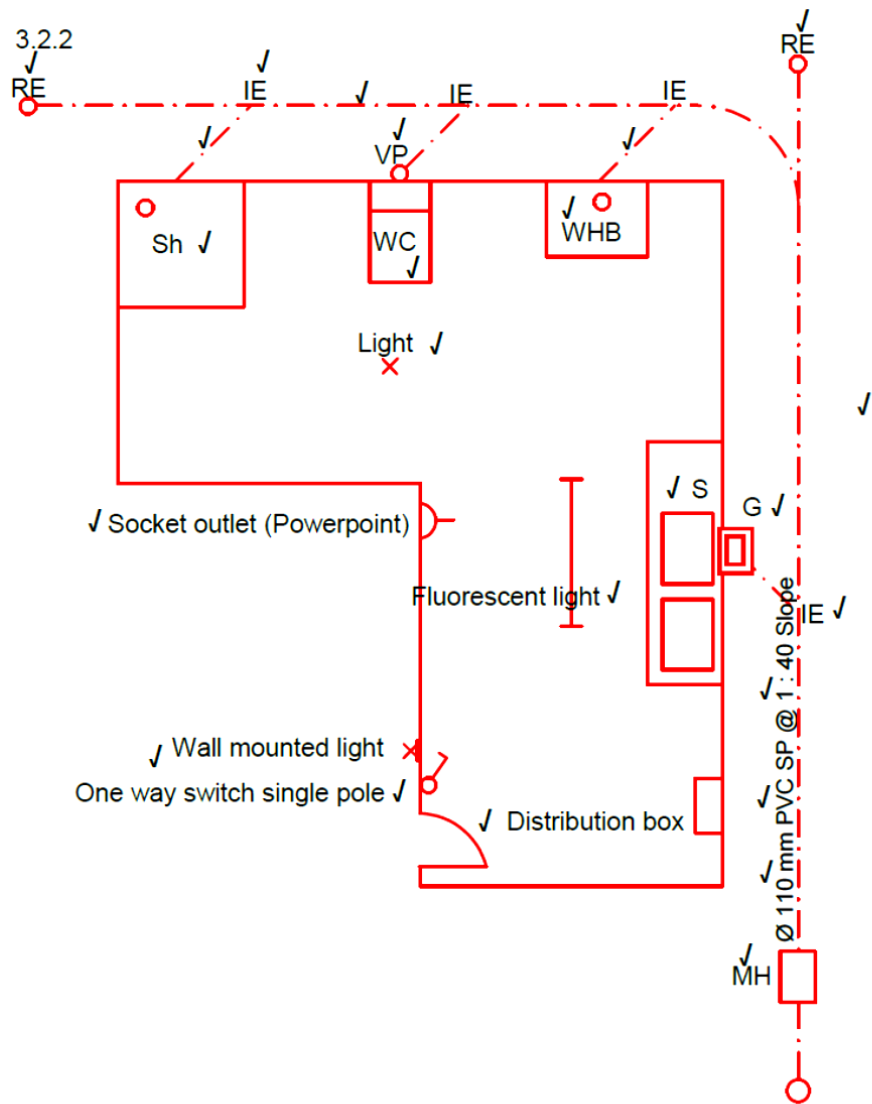
	Assessment Criteria	Marks	LM
3.2.1	Sanitary symbols	4	
3.2.2	Manhole	1	
	Gulley	1	
	Vent pipe	1	
	Rodding eye	2	
	Inspection eye	2	
	Correct sewerage layout	2	
	Sanitary abbreviations	2	
	3.2.3	Description of pipe	3
3.2.4	Electrical symbols	6	
	<b>Total</b>	<b>24</b>	

Connection to conservancy tank

LM = Learner's mark

**Memorandum/Marking guidelines**

3.2 3.2.1 & 3.2.2

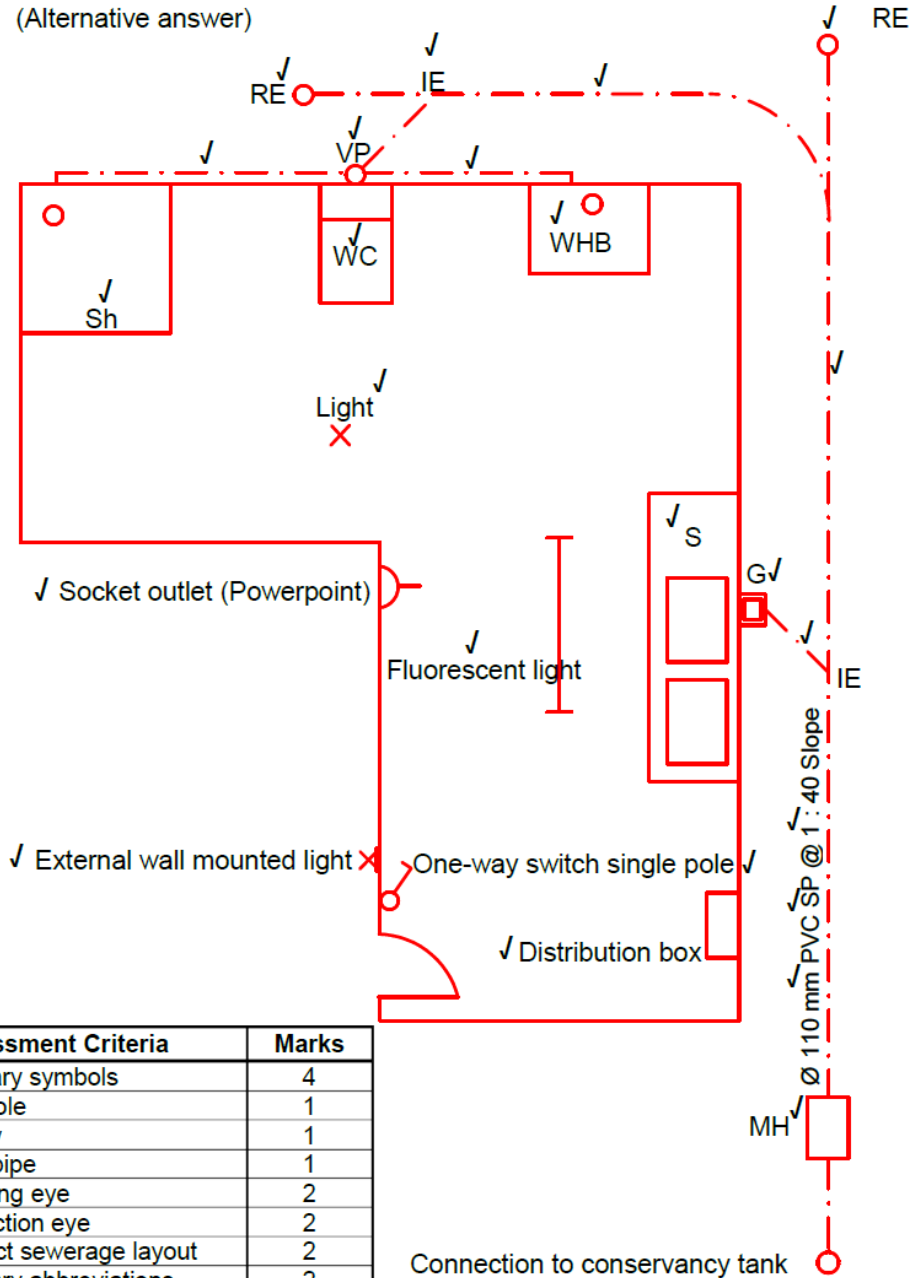


	Assessment Criteria	Marks
3.2.1	Sanitary symbols	4
3.2.2	Manhole	1
	Gulley	1
	Vent pipe	1
	Rodding eye	2
	Inspection eye	2
	Correct sewerage layout	2
	Sanitary abbreviations	2
3.2.3	Description of pipe	3
3.2.4	Electrical symbols	6
	<b>Total</b>	<b>24</b>

(24)

OR

3.2.2 (Alternative answer)



	Assessment Criteria	Marks
3.2.1	Sanitary symbols	4
3.2.2	Manhole	1
	Gully	1
	Vent pipe	1
	Rodding eye	2
	Inspection eye	2
	Correct sewerage layout	2
	Sanitary abbreviations	2
	3.2.3	Description of pipe
3.2.4	Electrical symbols	6
	<b>Total</b>	<b>24</b>

Connection to conservancy tank

(24)

[30]

100 mm PVC pipe is also acceptable

**Discussion:**

The question is classified as difficult because:

- The graphic text requires an analysis and understanding of a line diagram of an L-shaped building as well of the drawing symbols related to civil services. To answer the question, candidates need good knowledge of drawing symbols



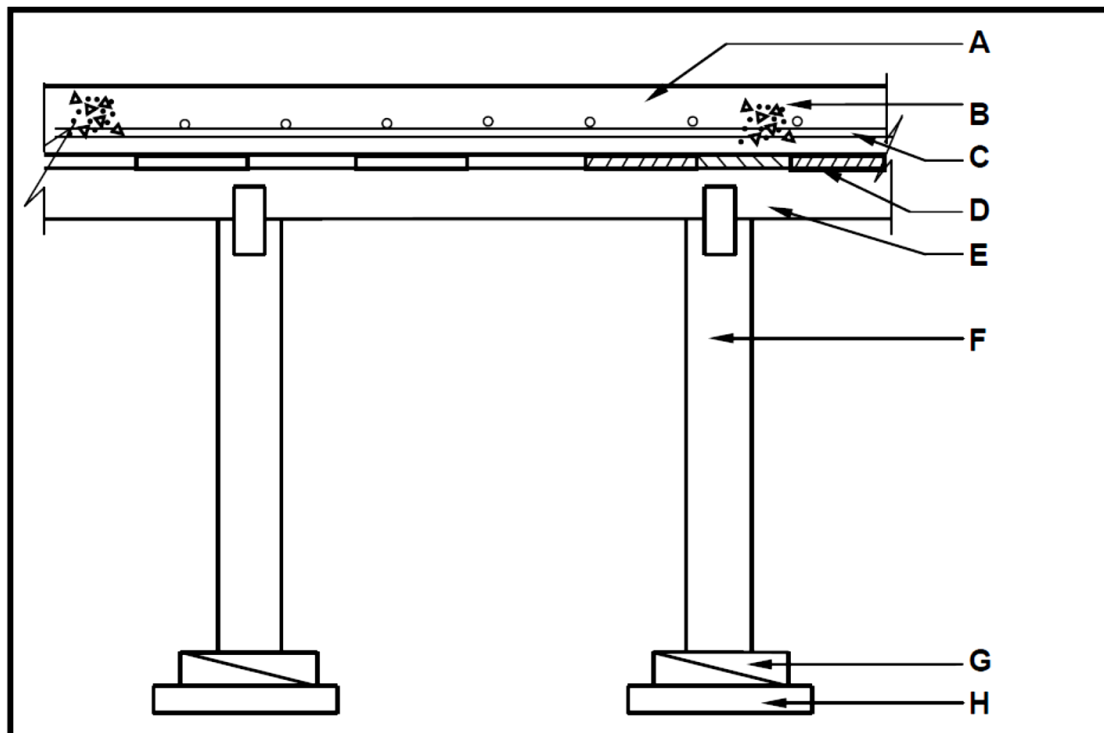
for sanitary fittings and fixtures and a sewage layout. They need to know all regulations and principles relating to the design of a sewerage system. Answering the question also requires a good understanding of the difference between technical terms like inspection eye and rodding eye, manhole and gulley in order to draw the layout. They should also combine their drawing skills by making use of the correct line types for the layout. They should apply their knowledge of principles related to a sewerage system in order to locate correctly the fixtures, fittings and pipes. They should also be aware of the number and positions of rodding eyes the regulations prescribed when a sewerage system changes from direction on the layout drawing of the sewerage system (content).

- To answer Question 3.2.2 candidates have to read and understand a lot of written and graphic text. This reading makes high demands on the envisaged Grade 12 candidate. The specific questions themselves are quite challenging to understand; the instructions are complex and candidates have to understand the subject specific phraseology and terminology used such as 'a rodding eye' and 'conservancy tank'. The source material consists of written text as well as a line diagram of an L-shaped building that is to be erected on a vacant stand. The numbers and drawing symbols in the diagram make the diagram difficult to interpret because it refers to two different concepts which have to be incorporate in the layout plan. The interpretation of the diagram is challenging because candidates must apply what they have read form the text to locate fixtures in the correct positions on the drawing in terms of SANS 10143 (stimulus).
- The *task* requires a high degree of technical comprehension from candidates. To answer these questions successfully, they have to interpret and analyse a large amount of written and graphic text. They need to understand the subject terminology and phraseology. This reading process is challenging and time consuming for the envisaged Grade 12 candidate because of the large amount of information that needs to be internalised. In their response, they also have to present information graphically. Candidates have to combine the variety of information in the written text and apply their knowledge to create the complicated layout plan for the sewerage system (task).
- The question is difficult because it does not specify the number of inspection eyes which gives candidates the opportunity to be creative in their design of the layout plan. Candidates should also know from where the branch pipes originates, the number of branch pipes applicable and at what angle it meets with main pipe. The correct type of line to indicate the sewerage line is very important and should be applied in the drawing. The two marks for the sewerage lines which require a lot of detail may create confusion about the number of detail to be indicated on the drawing. The question is more difficult to mark because two possible methods can be used for the layout of the sewerage system at the back of the house. The marker must analyse the answer to see if it meets the requirements in the memorandum (expected response).

**Example 3:**

**Question 2.1: November 2012, DBE**

2.1 FIGURE 2.1 below shows formwork supporting a concrete floor. Analyse the illustration and answer the questions that follow.



- 2.1.1 Identify the components **A** to **H**. (8)
- 2.1.2 Explain why the reinforcement in the concrete floor is placed closer to the bottom of the floor. (2)
- 2.1.3 Explain the purpose of **G**. (1)
- 2.1.4 Explain the purpose of **H**. (1)

**Memorandum/Marking guidelines**

2.1.1

- A. Floor slab. ✓
- B. Concrete (symbol for concrete). ✓
- C. Reinforcing mesh/main bars. ✓
- D. Shutter board/soffit board. ✓
- E. Bearer/Joist. ✓
- F. Prop/post/pole. ✓
- G. Wedges. ✓
- H. Sole plate. ✓ (8)

2.1.2

Concrete is weak in tensile strength and the most tension in the floor slab will occur at the bottom ✓ due to bending and the reinforcing will serve no purpose when placed on the top.

**ANY OTHER ACCEPTABLE ANSWER (2)**

2.1.3

G – To assist with the alignment of formwork ✓  
To secure the prop in position

To ease dismantling

**ANY ONE OF THE ABOVE OR OTHER ACCEPTABLE ANSWER (1)**

2.1.4

H – To prevent props from sagging√

To distribute the load to the load-bearing surface

**ANY ONE OF THE ABOVE OR OTHER ACCEPTABLE ANSWER (1)**

**Discussion:**

This question is classified as difficult because:

- The envisaged Grade 12 candidate is provided with a complex diagram of a formwork supporting a concrete floor. Candidates must analyse the diagram and apply their knowledge of formwork to identify the different components in question 2.1.1. This is a difficult question because the envisaged Grade 12 candidate must recall more information on parts of formwork to identify the parts. The question does not have a list to choose from which makes it difficult to answer. To answer Questions 2.1.2 to 2.1.4 candidates need a good understanding of the function of certain parts in formwork. The purposes of these parts are difficult to answer because it implies that you have to know the part to be able to describe its purpose. In identifying the parts and the explanation of the purpose of certain parts, the envisaged Grade 12 candidate's knowledge is increased to test more elements. This makes this a difficult question to answer (content).
- The diagram requires a lot of interpretation and analysis because it contains much detail and is complex to interpret. The diagram is also not very common which requires more "reading" to gain a proper understanding of the information given. The information in the diagram requires a high degree of knowledge to understand and to be able to identify the parts in Question 2.1.1. In order to answer Questions 2.1.2 to 2.1.4 the envisaged Grade 12 candidate needs to unpack the questions and use the information in the diagram to answer the questions (stimulus).
- The *task* entails identifying eight parts of the formwork for a concrete floor. The envisaged Grade 12 candidate first has to analyse and interpret the diagram and recall and apply their knowledge in order to identify each part correct. The question is difficult because there is not a list of possible parts to choose from. To identify the parts without the names of the parts been given makes this task difficult rather than moderately difficult. In Questions, 2.1.2 to 2.1.4 candidates must show that they know the parts in order for them to explain the functions of the parts. Candidates also have to 'unravel' a fair amount of information to work out each answer which makes the task difficult (task).
- A lot of detail is expected in answering 2.1.1 to 2.1.4. The envisaged Grade 12 candidate has to write the numbers A – H and next to it the correct name of the part by applying their knowledge on formwork to identify the parts. Eight marks are allocated for eight difficult responses. The number of responses required also makes the question difficult rather than moderately difficult for the envisaged Grade 12 candidate. The *expected responses* are not straightforward and require deep thinking for the complex answers (expected response).

**TABLE 10: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 4 – VERY DIFFICULT**

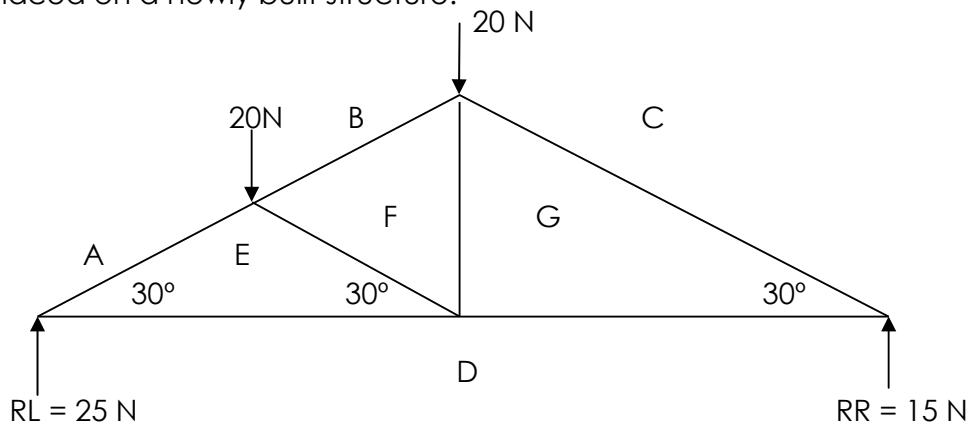
**Note:**

During the development of the exemplar book some subject specialist argued that there is a faint line between a difficult and a very difficult question. It was also evident that in some subjects question papers did not have questions that could be categorised as very difficult. In order to cater for this category, subject specialists were requested to adapt existing questions and make them very difficult or create their own examples of very difficult question. However, it was noted that in some instances attempts to create very difficult questions introduced invalid sources of difficulty which in turn rendered the questions invalid. Hence, Umalusi acknowledges that the very difficult category may be problematic and therefore requires especially careful scrutiny.

**Example 1:**

**Question 5.2 November 2008:**

5.2 FIGURE 5.2 below shows the design of a roof truss that has to be placed on a newly built structure.



**FIGURE 5.2**

2.2.1 Determine graphically the magnitude and nature of the forces in the structure.

Use ANSWER SHEET 5.2.1.

(Use a scale of 3 mm = 1 N)

(6)

5.2.2 Complete the table below on ANSWER SHEET 5.2.2.

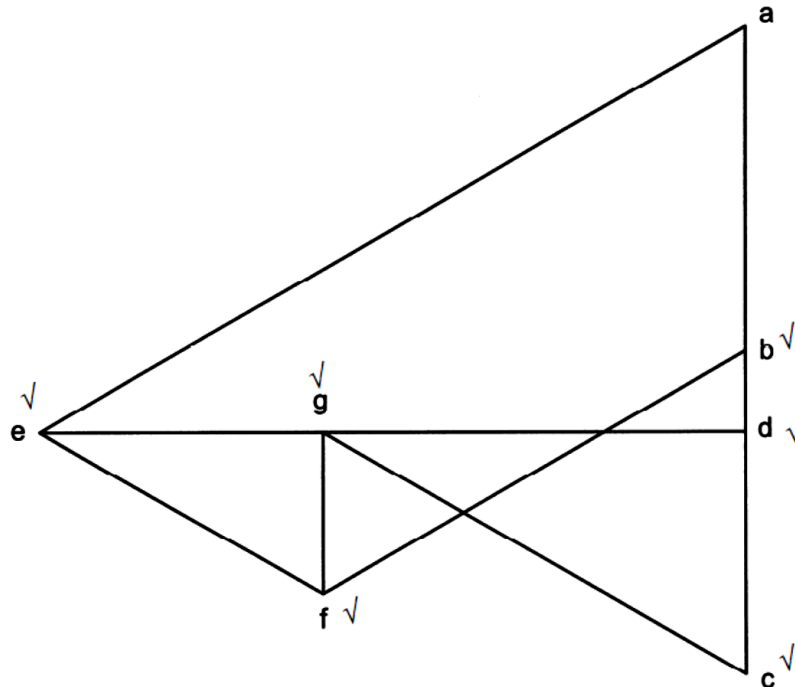
MEMBER	MAGNITUDE	NATURE
AE		
BF		
CG		
DE		
DG		
EF		
FG		

(14)

**Memorandum/Marking guidelines**

5.2.1 Force diagram

**ANSWER SHEET 5.2.1**



**NOT TO SCALE (6)**

<b>MEMBER</b>	<b>MAGNITUDE</b>	<b>NATURE</b>
<b>AE</b>	75 N ✓	STRUT ✓
<b>BF</b>	45 N ✓	STRUT ✓
<b>CG</b>	45 N ✓	STRUT ✓
<b>DE</b>	65 N ✓	TIE ✓
<b>DG</b>	39 N ✓	TIE ✓
<b>EF</b>	30 N ✓	STRUT ✓
<b>FG</b>	15 N ✓	TIE ✓

(14)

### **Discussion:**

These questions are all categorised as very difficult because:

- The envisaged Grade 12 candidate requires extensive and specialised knowledge of how to draw a vector diagram as well as of how to determine the magnitude and nature of the forces. They need to know how many members are in the roof truss, how to apply BOW's notation, the steps to draw a vector diagram and apply the convention to draw lines parallel to the corresponding member in the space diagram. They should also be knowledgeable on how to determine the nature of forces and how to indicate the nature of the forces by means of arrows on the space diagram. They should also know how to convert the millimetres measured to the magnitude of the force using the given scale. The knowledge and skills required to answer this question is extremely difficult for the envisaged Grade 12 candidate (content).
- The question provides candidates with little guidance as to what to do other than to tell them to determine graphically the magnitude and nature of the forces. The space diagram and table given in the question paper appears to be easy, but it requires a lot of high order thinking and an analysis to draw the solution and to complete the table. The envisaged Grade 12 candidate must be able to understand and know how to apply BOW's notation in developing the vector diagram (stimulus).
- To determine the magnitude and nature of the forces in the roof truss candidates should analyse the given written and graphic information, then they must develop and draw the vector diagram from where the required information for the completion of the table, will be deduced. Candidates need to recognise that a vector diagram needs to be drawn in order to determine the magnitude and nature of the forces. Generating or creating a vector diagram to determine the nature of the forces requires high order thinking skill. To draw the vector diagram and to indicate the nature of the forces requires the execution of a variety of steps. Candidates have to apply their drawing and measuring skills. They have to apply mathematical skills to convert the measurements into the magnitude and other way round (task).
- Candidates are required to draw a very difficult vector diagram consisting of eight lines which are combined to form the solution. They must know how to correctly label the members in the vector diagram. The six marks for this complicated drawing means that candidates have to show much more detail than the marks are allocated for. The high number of information required for the little marks is indicative of the very difficult nature of the question. Candidates must also be able to use the information in the vector diagram to complete the table. To complete the magnitude of the forces they must know which members to measure and how to convert the millimetres to Newton by means of the scale. To determine the nature of the forces, the candidate requires high order thinking skills for a very abstract concept. The one-word answers in the table may seem to be easy, but requires a variety of skills to be applied, to get to the answer. The mark allocation for this very difficult answer is little, but is in line with the expectations of the subject norms. Candidates are required to consider the mark allocations and answer according to this guide (expected response).

**Example 2:**

Your Grade 12 Civil Technology class are tasked to design an additional store room for your Civil Technology centre. It is expected of you to develop and draw the South elevation of the storeroom using the specifications described below.

**Specifications:**

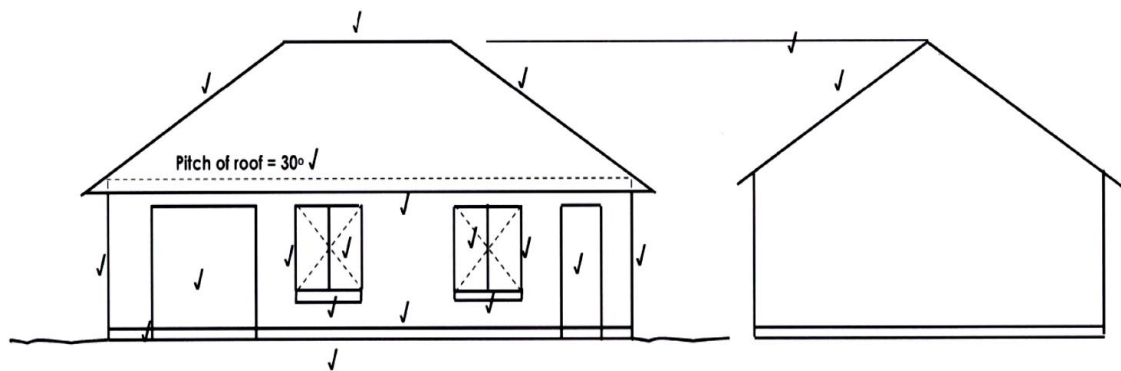
- The store room has a rectangular shape with outside measurements of 12 000 mm x 8000 mm.
- The 12 000 mm sides are facing South and North.
- The door opening is 2100 mm high and 900 mm wide is located 660 mm from the outside of the right-hand corner on the South elevation.
- The garage-door opening is 2400 mm wide and 2100 mm high and is located 1000 mm from the outside of the left hand corner on the South elevation.
- Two windows 2100 mm wide and 1200 mm high are located on both sides of the door on the North and South elevation.
- One window 1800 mm wide and 1200 mm high are located on the East and West elevation.
- The height between the natural ground level and the top of level of the floor slab is 300 mm.
- The height between the top level of the floor slab and the underside of the wall plate is 2600 mm.
- The door steps are 150 mm high.
- The wall plate is 114 mm x 38 mm.
- The building has a hipped roof with a pitch of 30°.
- The roof is covered with galvanised sheeting and is finished with 220 mm wide fascia boards.
- The overhang of the open-eaves is 400 mm.

1.1 Draw and develop on a scale of 1:50 on ANSWER SHEET 1 the SOUTH ELEVATION of a store room for your school. Use the specifications as indicated.

**Note: Use your own discretion where dimensions and/or details are omitted.**

**Memorandum/Marking guidelines**

Assessment criteria	Marks	LM
Correctness of drawing	2	
Length of wall	1	
Natural ground level	1	
Height of wall	2	
Determination of roof height	2	
Pitch of roof is 30°	1	
Roof	4	
Door opening	1	
Opening for garage roll-up door	1	
Ramps in front of two doors	1	
Windows	2	
Opening direction of windows	2	
Window sills	2	
Accuracy of scale Application of scale One or two incorrect = 3 Three or four incorrect = 2 More than five incorrect = 1 No measurement correct = 0	3	
<b>TOTAL:</b>	<b>25</b>	



Correctness of drawing = ✓✓  
 Application of scale = ✓✓✓

**DRAWING NOT TO SCALE**

**USE A MASK TO MARK THIS QUESTION**

**Discussion:**

The questions are all categorised as very difficult because:

- The envisaged Grade 12 candidate requires extensive and specialised knowledge of how to transfer a complex text to draw a South elevation. A variety of knowledge elements are tested, e.g. knowledge of floor plans, elevations of a house, hipped roof and the identification of parts of a house. This question did not indicate that in order to be able to draw the answer a freehand drawing should first be drawn, this includes a conversion of complex sentences into a drawing. Candidates must therefore apply their sketching skills to draw the floor plan. The floor plan is needed to get the information from to draw the South elevation. Candidates must also know that according to the Code of Practice for Building Drawings (SANS CODE 10143) the north point points to the top or left of a drawing. Candidates must apply their knowledge and drawing skills to draw the solution, to correctly label and dimension the solution according SANS. Candidates should also know how to draw accurately according to the given scale. The question deals with a real-life situation where a future house owner gives information in writing and requires a drawing. The difficulty in content increase because candidates are expected to use their own discretion where dimensions or details are omitted. The knowledge and skills required to interpret the source is very difficult for the envisaged Grade 12 candidate (content).
- The question includes more written information to be interpreted and unpacked. It tests the comprehension skills as well as the subject knowledge and makes high reading demands on candidates. It requires candidates to conceptualise the information and organise it in a logical order for them to be able to draw the answer. The question itself provides candidates with little guidance as to what to do other than to tell them to draw the South elevation. Candidates must create the solution by choosing the correct and relevant information from a very difficult and unstructured text. The irrelevant information cannot be excluded because then it will give away the elevation to be drawn (stimulus).
- To draw this elevation candidates should analyse the given text to develop and draw the South elevation. Candidates need to select the relevant text



to draw the South elevation. They should devise their own steps to draw the South elevation of the house. In order for them to produce the South elevation and to label and dimension, the drawing requires the execution of a range of steps. Candidates have to apply their drawing and measuring skills. They have to apply mathematical skills to convert the measurements into the applicable scale to draw the solution accurately. To analyse the information as well as develop and draw the South elevation, makes this a very difficult question to answer (task).

- Candidates are required to draw a very difficult solution from abstract and unstructured information. The solution requires more details to be shown; e.g. door, windows, the way to determine the height of the gable roof, etc. To be able to draw this complex drawing, the envisaged Grade 12 candidate must be able to visualise the possible solution and make use of a range of steps to draw the solution. Candidates need to demonstrate the skill to correctly label and dimension the drawing. The mark allocation in the memorandum correlates with the complicated drawing and is in line with the expected very difficult response of candidates. Candidates are required to create a new complex drawing because of the number of elements indicated in the question (expected response).

## **9 CONCLUDING REMARKS**

This exemplar book is intended to be used as a training tool to ensure that all role players in the Civil Technology Examination are working from a common set of principles, concepts, tools and frameworks for assessing cognitive challenge when examinations are set, moderated and evaluated.

We hope that the discussion provided and the examples of questions shown by level and type of cognitive demand and later by level of difficulty assist users of the exemplar book to achieve this goal.

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