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COUNCIL FOR QUALITY ASSURANCE IN GENERAL AND FURTHER EDUCATION AND TRAINING

Exemplar Book on Effective Questioning

Agricultural 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 Agricultural 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

Abbreviation	Full name
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

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ACKNOWLEDGEMENTS

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In addition, Agricultural 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 Dr Fourten Khumalo.

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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 Agricultural 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 Agricultural 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) Agricultural 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 Agricultural 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 Agricultural 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 Agricultural 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 Agricultural Technology evaluators from previous DBE and the IEB Agricultural 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 Agricultural 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 Agricultural 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 AGRICULTURAL 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 Agricultural Technology CAPS document states that Grade 12 NSC Agricultural Technology examination papers should examine three levels of cognitive demand (Table 1).

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

The three levels of the Agricultural Technology assessment taxonomy	
Level of cognitive demand	Type of cognitive demand
Level 1	Remembering
Level 2	Understanding and application
Level 3	Creating, evaluating and analysing

Source: Examination guidelines (DBE, 2014, p.5)

To facilitate reading of this section, each of the above cognitive demand levels in the Agricultural Technology Taxonomy are explained, and the explanation is followed by at least **three** examples of questions from previous Agricultural 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 Agricultural Technology experts could find. 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 5).

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: REMEMBERING

Example 1:
Question (6.1.2,2011, Agricultural Technology): *Answer the following question on water scheduling:* Name TWO pieces of equipment that can be used to determine the evaporation in a specific field.
Discussion: The word 'name' suggests that this is a recall type of question. To answer the question Grade 12 candidates have to recall information on equipment used to determine evaporation in a specific field. This is basic content for Grade 12 candidates who should all know the two pieces of equipment used to determine evaporation. The question is thus classified as a lower order 'knowledge' question. It involves recall of fundamental Agricultural Technology knowledge.
Memorandum/Marking guidelines 6.1.2 Two pieces of equipment Tensiometer. √ Class A evaporation pan. √ Moisture probe. √ (Any 2) (2)
Example 2:
Question (3.2.1, 2013, Agricultural Technology): *The photograph below shows two different energy sources that are used to produce electricity for a milking parlour on a dairy farm. Use the photograph to answer the questions that follow.* FIGURE 1: DIFFERENT ENERGY SOURCES

List FOUR advantages of alternative energy sources.

Discussion:

Action verbs such as 'list' usually (but not always) indicate that the cognitive process required by candidates to answer the question is remembering. To answer this question, candidates have to recall four advantages of alternative energy sources by referring to the photograph provided in the question which shows two different energy sources that are used to produce electricity. In order to respond to the question, they must recall what they have learnt about alternative energy sources. Although they are provided with a photograph, they do not have to interpret or analyse it, they must simply remember and list four advantages of alternative energy sources. Thus, the question is classified as a recall of fundamental Agricultural Technology knowledge type of question.

Memorandum/Marking guidelines

3.2.1 Advantages of alternative energy sources:

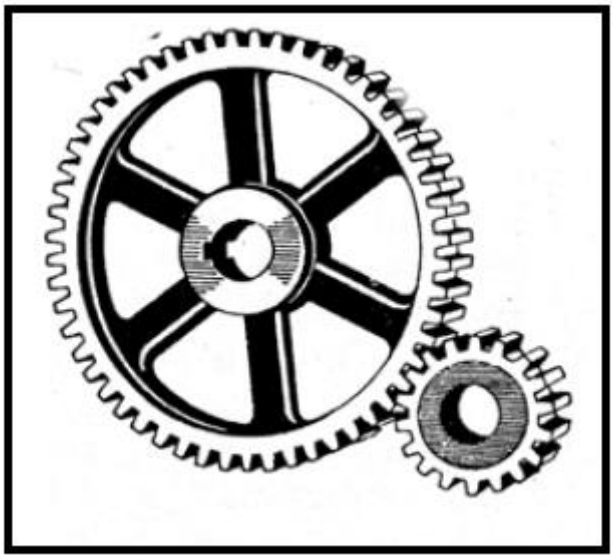
- No fuel costs. √
- Low maintenance costs no clean-up costs. √
- No carbon tax costs. √
- Reduced oil imports. √
- No air pollution/environmentally friendly√.
- Renewable energy source. √
- Solar/wind power technology is limitless. √
- Solar/wind is also extremely portable. √
- Great resource to generate energy in remote locations. √ (Any 4) (4)

Example 3:

Question (5.5, 2013, Agricultural Technology):

The efficient working of a tractor gearbox is made possible by a combination of gears to achieve the best possible ratio for the specific job. The illustration below shows one type of gear set that can be used in the gearbox of a tractor.

FIGURE 2: TYPE OF GEAR SET



5.5.1 Identify the type of gear set shown in the illustration above.

5.5.3 State the THREE types of gear boxes commonly used in tractors.

Discussion:

Both these sub-questions require remembering and recognizing basic factual knowledge. To answer sub-questions 5.5.1 and 5.5.3 candidates have to recall knowledge, which they should have learnt about in class and/or from textbooks or other source material, of types of gear sets and also the types of gear boxes commonly found in tractors. The two action verbs used namely, 'identify' and 'state' usually (but not always) indicate that the cognitive processes required to answer the questions are remembering and/or recognising. In this question, candidates are provided with an illustration which shows one type of gear set that can be used in the gear box of a tractor. Although candidates are provided with the illustration in Question 5.5.1, they do not have to interpret or analyse it, they have to recognize the type of gear box shown. In Question 5.5.3, they have to recall and state the types of gear boxes commonly used in tractors. Thus, both sub-questions are classified as recall and recognition of fundamental Agricultural Technology knowledge type questions.

Memorandum/Marking guidelines

5.5.1 Type of gear

- Straight cut gear/spur gear. √ (1)

5.5.3 Types of gears commonly used in tractors

- Sliding gearbox/Manual. √
- Constant mesh gearbox. √
- Synchronized gearbox. √
- Automatic. √
- Triptronic. √
- Pre-select. √ (Any 3) (3)

TABLE 3: EXAMPLES OF QUESTIONS AT LEVEL 2: UNDERSTANDING AND APPLICATION

Example 1:

Question (3.1, 2011, Agricultural Technology):

To generate wind power, you need to be able to capture energy from the force of the wind by using a device similar to the one shown in the picture below.

FIGURE 3: DEVICE TO CAPTURE WIND ENERGY

3.1.2 Before purchasing a small wind turbine for the farm, the farmer should consider some factors which meet the requirements for installing a wind turbine. Explain FIVE requirements the farmer should consider.

Discussion:

This is a middle order question. All Grade 12 candidates should have learnt about the topic of 'wind turbines' in class. However, to answer this question, candidates cannot simply provide learnt definitions of wind turbines and of their installation requirements (which would be a 'remembering' task). In order to explain five requirements that the farmer needs to consider before purchasing a small wind turbine, candidates have to understand the principles and procedures for installing a wind turbine and apply this knowledge in a particular context, namely, on a farm. Thus, the question is classified as a comprehension and application of Agricultural Technology knowledge type question. Comprehension involves more than recall of facts or information; it entails showing understanding and insight. Here, candidates have to do more than simply recall requirements for installing a wind turbine; they have to apply knowledge in a specific context.

Memorandum/Marking guidelines

3.1.2 Requirements for installing a wind turbine:

- Cost effectiveness and efficiency. √
- Wind speed to generate adequate electricity efficiently. √
- Open spaces are more suitable. √
- Do not use in mountainous area. √

- Do not use near forests. √
- Expert advice should be gained before purchasing a wind turbine. √
- It can be connected to your power supply to provide your home with an extra boost in electricity. √
- Wind energy technology can be combined with other alternative energy sources of energy. √
- Amount of energy needed √ (Any 5) (5)

Example 2:

<u>Question (6.2, 2011, Agricultural Technology)</u>:

Drainage is a process to remove excess or free water from the upper layers of waterlogged soil.

6.2.3 Calculate the flow rate of water in a pipe delivery system by using the following data:

- The capacity of the tank is 8000 litres.
- It took 8 hours to fill the tank to the top.

<u>Discussion</u>:

This question is classified as making middle order cognitive demands. The action verb 'calculate'; clearly indicates that candidates need to calculate the flow rate of water in a pipe delivery system. They also have to understand the meaning of the information provided which relates to the flow rate of water in a pipeline delivery system. They have to perform the required procedure and understand concepts relating to the removal of excess or free water in a waterlogged soil. To perform the necessary procedure, they have to select the appropriate information from that which is available, such as the capacity of the tank which is 8000 litres and the fact that it took 8 hours to fill the tank to the top, and insert the required figures into the correct formula for calculating the flow rate of water. The cognitive processes required to answer the question are thus understanding and application.

<u>Memorandum/Marking guidelines</u>

6.2.3 Calculation of flow rate

Flow rate = $\frac{\text{Content}}{\text{Time}}$ OR 1000 √√ litres per hour√√

= $\frac{8000}{8}$√

= 1000√ litres per hour√ (4)

Example 3:

<u>Question (4.4, 2013, Agricultural Technology)</u>:

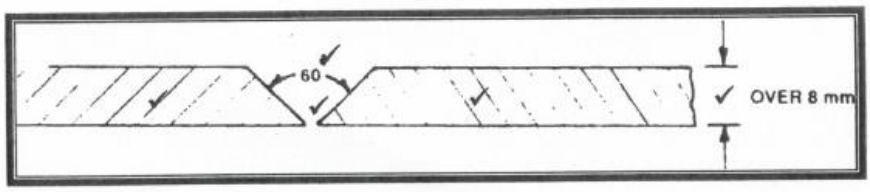
Make a neat sketch of a V-butt weld between two pieces of metal 10 mm thick and label the drawing.

Discussion:

The question is classified as a medium order question requiring understanding and application of knowledge. The question requires candidates to make a neat sketch of a V-butt weld between two pieces of metal 10 mm thick showing appropriate labels. Candidates should have learnt about V-butt weld in class. However, to answer this question and make and label the required sketch, candidates have to understand the concept of a V-butt and apply this concept in the particular situation – 'a V-butt weld between two pieces of metal 10mm thick'. The question is therefore classified as an under understanding and the application type question. It is not a recall question as they would not have seen such a sketch before. Neither is it a creative task because they don't have to create an original drawing, they only need to apply their understanding.

Memorandum/Marking guidelines

4.4 Sketch of a V-butt weld.



(5)

TABLE 4: EXAMPLES OF QUESTIONS AT LEVEL 3: CREATING, EVALUATING AND ANALYSING

Example 1:

Question (4.3, 2012, Agricultural Technology – Adapted):

Create a neat, labelled sketch of the forehand welding technique welding with an oxy-acetylene welding apparatus.

Marks will be awarded for:

- Labels
- Sketch
- Neatness

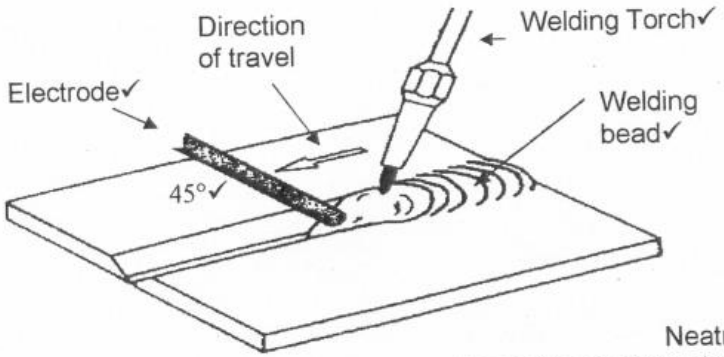
Discussion:

The action verb for this question 'create' usually (but not always) suggests that a question involves a creative process. 'Creating' questions entail generating new ideas, products, or ways of viewing things, designing, constructing, planning, producing, or inventing. They also entail integrating ideas and information and

relating parts of material, ideas or information to one another and to an overall structure or purpose in a way that is relational (i.e. synthesizing). To answer this question, candidates cannot simply recall what they have learnt in class. They would not have seen a diagram such as the one required before. Furthermore, unlike Example 3 in Table 4, they do not simply have to understand and apply knowledge of the forehand welding technique in a particular context. To answer this question, they have to go beyond applying their understanding; they have to integrate or synthesize ideas and information about the forehand welding technique and relate the ideas and information to welding with oxy-acetylene welding apparatus. They have to plan, design, draw and label an original sketch. To create something is not normally used in the Grade 12 class of Agricultural Technology. This is why candidates will find it difficult to answer this question. Therefore, the cognitive processes involved in answering this question are higher order processes.

Memorandum/Marking guidelines

4.3 Diagram of the forehand welding technique



Neatness✓
Correctness of the sketch✓✓ (8)

Example 2:

Question (6.4, 2011, Agricultural Technology – Adapted):

Irrigation pipes are often buried underneath the soil. Recommend TWO precautionary measures that should be taken when these pipes are laid.

Discussion:

The action verb in this question 'recommend' usually (but not always) suggests that a question may be an evaluation question. Evaluation questions require candidates to make critical judgements using criteria provided by other sources or authorities, or candidates' own experiences or background knowledge of the topic. They entail making decisions based on in-depth reflection, criticism and assessment. Such questions involve processes such as justifying a decision or course of action, checking, hypothesizing, critiquing, experimenting, testing, detecting and monitoring. To answer this question, candidates have to recommend two precautionary measures that should be taken into account when irrigation pipes are laid. Answering the question requires a sound knowledge and understanding of the topic 'irrigation and water supply' but they cannot simply recall what they have learnt in class about precautionary measures one should take when laying pipes

underground. In this evaluation question, they have to solve the problem by making a judgement and giving their reasons or motivate their choices. The question is therefore classified as a higher order question.

Memorandum/Marking guidelines

6.4 Precautionary measures when laying pipes:

- Bury deep enough not to be damaged by implements. √
- Bury in sand. √
- Couplings must be firm and water tight√
- A layer of lime should cover the pipeline about 600 mm above the pipe to prevent damaging the pipe at a later stage. √ (Any 2) (2)

Example 3:

Question (2.5, 2011, Agricultural Technology):

Answer the following questions on electric fences.

2.5.2 Electrical fences on a farm are not always the answer to a farmer's problem. Discuss the disadvantages of electrical fences.

Discussion:

The action verb 'discuss' usually (but not always) suggests that a question is a comprehension question. However, here candidates have to go beyond showing understanding; they have to engage in more abstract reasoning and analysis. Analysis questions require inferential reasoning and interpretation of information. They involve breaking information into parts to best understand relationships between the parts. Such questions involve processes such as comparing, organising, deconstructing, attributing, outlining, finding, structuring and integrating. To answer this question, candidates have to analyse the disadvantages of electrical fences in a specific scenario, that of farms. Answering the question goes beyond application of knowledge and understanding of the disadvantages of electrical fencing because candidates also have to make a principled analysis as to which of the disadvantages of electrical fending that they have learnt about would be relevant in a farm setting and why. The question is therefore classified as a higher order question.

Memorandum/Marking guidelines

2.5.2 Disadvantages of electrical fences

- Potential for the entire fence to be disabled due to a break in any conducting wire. √
- Shorting out if the conducting wire makes contact with any non-electrified components of the fence. √
- Power failures. √
- Veld fires due to dry vegetation touching the wires. √
- Children or pets touching wires by accident. √ (Any 3) (3)

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 contribute to the cognitive challenge of a 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 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 Agricultural 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 6 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
Easy for the envisaged Grade 12 student to answer.	**Moderately challenging** for the envisaged Grade 12 student to answer.	**Difficult** for the envisaged Grade 12 student to answer.	**Very difficult** for the envisaged Grade 12 student to answer. The skills and knowledge required to answer the question allow for the top students (*extremely* high-achieving/ability students) to be discriminated from other high achieving/ability students).

Note:
The forth 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 Agricultural 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 Agricultural Technology candidates in South Africa. The revised Umalusi NSC examination evaluation instruments thus emphasise that, when rating the level of 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 Agricultural Technology learners in South Africa to be.

Note:
The concept of the ***ideal 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 6). Please read the entire table very carefully.

TABLE 6: FRAMEWORK FOR THINKING ABOUT QUESTION DIFFICULTY

CONTENT/CONCEPT DIFFICULTY
Content/concept difficulty indexes the difficulty in the **subject matter, topic or conceptual knowledge** assessed or required. In this judgment of the item/question, difficulty exists in the **academic and conceptual demands** that questions make and/or the **grade level** boundaries of the various 'elements' of domain/subject knowledge (topics, facts, concepts, principles and procedures associated with the subject).
For example:
Questions that assess '**advanced content'**, that is, subject knowledge that is considered to be in advance of the grade level curriculum, are *likely* 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 *likely* to be moderately difficult for most candidates. Questions that assess **'basic content'** or subject knowledge candidates would have learnt at lower grade levels, and which would be familiar to them are *unlikely* 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 operations 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 that **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 to 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 Agricultural Technology NSC examinations (Table 7 to Table 10) categorised at each of the four levels of difficulty described in Section 7 (Table 6) above. These examples were selected to represent the **best and clearest** examples of each level of difficulty that the Agricultural 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

Example 1:

Question (3.1, 2013, Agricultural Technology):

The photograph below shows a portable electric fence in a field. Answer the questions that follow.

FIGURE 4: PORTABLE ELECTRIC FENCE IN A FIELD

3.1.1 Name an alternative energy source that can be used to charge the battery effectively. (1)
3.1.2 Name any TWO uses of portable electric fences on a farm. (2)
3.1.3 State TWO benefits of using portable electric fences on a farm. (2)

Discussion:

These three sub-questions for Question 3.1 are all classified as 'easy' because:

- These three sub-questions assess basic subject knowledge about alternative energy sources and portable electric fences. Candidates need to know the name of just one energy source that can be used to charge the battery. They also need to know just two uses of portable electric fences on farms. Candidates need to know two benefits of using portable electric fences on a farm. All Agricultural Technology candidates should be familiar with this content – they should have learnt about it in class and through real life observations **(content)**.
- The material provided as stimulus for this question does not require much interpretation and is really included to signal the topic of the question. The lead sentence and heading makes it very clear as to what the photograph shows - they are looking at – a portable electric fence in a field. The photograph explicitly shows features found in a portable electric fence with farm animals in the background **(stimulus)**.
- To answer the question, candidates do not really have to interpret or refer to the stimulus material provided. All they need to do to answer the questions is recall what they should have learnt in class about alternative energy sources

and portable electric fences on farms and write down the name of one energy source, two uses and two benefits of portable electric fences on a farm. There are a variety of energy sources that they can choose from and more than two uses and benefits of portable electric fences but they have to name any two. The three sub-questions are straightforward and easy to read and comprehend. The terms 'alternative energy source', 'effectively', 'portable electric fence' and 'benefits' should all be familiar to Agricultural Technology candidates **(task)**.

- According to the memorandum one mark is awarded for each correct response; candidates get one mark for writing one correct name; two marks for two uses, and two marks for two benefits. The marking guidelines make provision for two possible answers for Question 3.1.1; and four possible answers for Question 3.1.2; and seven possible answers for Question 3.1.3. The mark allocation is therefore straightforward and markers should have no difficulty in marking responses. The answers expected for both question are easy to formulate and do not entail much writing – candidates only have to write short phrases or sentences. The envisaged Grade 12 candidate should easily get the marks allocated for these sub-questions **(expected response).**

The sub-questions are therefore easy with regard to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

3.1.1 Alternative energy source:

- Solar (sun)/ Wind. √ (1)

3.1.2 Uses of portable electric fences:

- Keeping wild animals and vermin away from domesticated farm animals and crops. √
- Separate different groups of animals. √
- Allowing rotational grazing. √
- Fencing animals off from eroded areas, trees, rivers and roads. √ (Any 2) (2)

3.1.3 Benefits of using portable electric fences:

Affordable. √

Easily constructed. √

Durable. √

Light weight. √

Easily modified. √

Less animal hide and pelt damage. √

Deterrent to trespassers and predators. √ (Any 2) (2)

Example 2:

Question (2.2, 2011, Agricultural Technology):

Answer the following questions on adhesives used in materials and structures.

2.2.1 Name the TWO most important aspects to consider when an adhesive is chosen for a specific job. (2)

2.2.3 Name any THREE safety measures when using synthetic materials. (3)

Discussion:

These two sub- questions are classified as 'easy' because:

- Both sub-questions assess fundamental subject knowledge that all Grade 12 Agricultural Technology candidates should have learnt in class and from their textbooks or notes. Candidates need to know about adhesives and synthetic material. Question 2.2.1 assesses a single knowledge element namely, 'an adhesive'. Question 2.2.3 also assesses a single knowledge element namely, 'synthetic materials'. The topic on adhesives used in materials and structures is easy for the envisaged Grade 12 candidate **(content)**.
- Both Questions 2.2.1 and 2.2.3 are easy to read and understand; the requirements are very explicit. The two sub-questions do not contain any superfluous or unnecessary detail which could distract candidates from understanding what is required **(stimulus)**.
- Question 2.2.1 requires candidates to name the two most important aspects to consider when an adhesive is chosen for a specific job. Question 2.2.2 requires candidates to name any three safety measures when using synthetic materials. The task is to recall simple factual information **(task)**.
- The mark allocation and memorandum are very straightforward; candidates get two marks for naming two important aspects to consider when an adhesive is chosen and three marks for naming three safety measures when using synthetic materials. The marking guidelines make provision for three possible answers for Question 2.2.1, and seven possible answers for Question 2.2.3. The answers expected are short and marking should be straightforward. The answers are easy to formulate as they involve writing short phrases or sentences. The envisaged Grade 12 candidate should easily get the marks allocated for both these sub-questions **(expected response)**.

These sub-questions are thus easy in relation to the stimulus, content, task and expected response.

Memorandum/Marking guidelines

2.2.1 Aspects to consider when choosing an adhesive:

- Type of material to be joined. √
- Conditions under which the joint will be used. √ (2)

2.2.3 Safety measures when using synthetic materials

- Catalyst and accelerator should always be stored separately (explosion). √
- Remove all resin catalyst and accelerator from skin. √
- Wear gloves if skin is sensitive. √
- Only use acetone in well-ventilated room. √
- Handle resin casting carefully because they are brittle. √
- Do not breathe in glass fibre. √
- Do not get it in your eyes. √ (Any 3) (3)

Example 3:

Question (5.3, 2012, Agricultural Technology): Adapted

5.3 Gear boxes are used in vehicles to make it possible to select the correct gear ratio for the job that must be done.

5.3.1 Name THREE different types of gearboxes that can be used in a vehicle. (3)

5.3.2 Give the disadvantage of straight-cut gears? (1)

Discussion:

These sub-questions are classified as 'easy' because:

- Answering these questions requires basic knowledge of two easy concepts 'gear boxes' and 'straight-cut gears'. All Grade 12 candidates should have learnt about gear boxes and straight-cut gears in class. They should also have seen gearboxes and straight-cut gears in the school workshop and in their everyday life **(content)**.
- The leading statement provided before the actual question helps focus candidates' attention on the topic in hand. The leading statement is brief and straightforward. The language used in the leading statement is suitable for the envisaged Grade 12 candidate. Candidates should all be familiar with the entire terms used in the leading statement. **(stimulus)**.
- In sub-question 5.3.1 candidates are required to recall three names of types of gearboxes that can be used in a vehicle. To answer sub-question 5.3.2, they have to give one disadvantage of straight-cut gears. Candidates have to write short phrases or sentences. **(task)**.
- The mark allocation is straight forward. Three marks are allocated for writing three answers in Question 5.3.1 and one mark is allocated for writing down one answer in Question 5.3.2. The marking guidelines make provision for three possible answers for Question 5.3.1, and two possible answers for question 5.3.2. The answers expected for both question are easy to formulate and do not entail much writing. The envisaged Grade 12 candidate should easily get the marks allocated for these questions **(expected response)**.

These sub-questions are thus easy in relation to the stimulus, content, task and expected response.

Memorandum/Marking guidelines

5.3.1 Types of gearboxes:

- Sliding gear box. √
- Constant mesh gear box. √
- Synchronized gear box. √
- Automatic. √
- Semi-automatic. √
- Pre-select. √
- Tiptronic .√ (Any 3) (3)

5.3.2 Disadvantage of straight-cut gear

- Noisy/excessive wear. √ (1)

TABLE 8: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 2 – MODERATE

Example 1:

Question (2.1, 2011, Agricultural Technology):

Metal is often used in materials and structures on the farm. Answer the questions on metals.

2.1.1 Name any THREE non-ferrous metals often used on farms. (3)

2.1.2 Alloys are a combination of two or more metals melted together to form new properties. Complete the table below in your ANSWER BOOK to show which metals are used to form the alloys as shown:

ALLOY	METALS
(a) Stainless steel	(3)
(b) Brass	(2)
(c) Solder	(2)

Discussion:

This question is classified as moderately difficult for the envisaged Grade 12 candidate because:

- To answer Question 2.1 candidates need to have knowledge of at least three non-ferrous metals that are often used in a farm. Candidates would also need to understand the difference between ferrous and non-ferrous. Drawing this distinction is moderately difficult for the envisaged Grade 12 candidate. To answer part ii) they need to be very familiar with examples of metals which combine to form a given alloy. **(content)**.
- The task in part i) entails recalling and writing the names of non-ferrous metals often used in farms. Candidates have to recognize the difference between ferrous and non-ferrous metals. They then have to apply their knowledge of

non-ferrous metals to a farm context. Candidates have to write the names of the metals in the designated column. They need to recognize (from the lead statement in the beginning of the part ii) that more than one metal is required for each alloy. Candidates have to work out for themselves how many metals to list for each alloy as the stimulus material does not specify how many metals are used in each of the alloys This aspect makes the task in part ii) moderately difficult **(task)**.

- Question 2.1 consists of two parts preceded by an introductory statement. The introductory statement clearly states that the subject of the question is metals that are often used in materials and structures on farms. This statement serves to orientate and focus candidates' attention on the subject in hand and the context. What makes the Question 2.1.1 difficult for the envisaged Grade 12 candidate is the term 'non-ferrous' because the term ferrous is not entirely familiar to candidates and the candidate will also be tempted to overlook the 'non' part of the term and, in error, name ferrous metals. The second part of the Question 2.1.2 begins with an explanation or definition, namely, that alloys are a combination of two or more metals melted together to form a new metal with new properties. This explanation provides a strong clue to candidates as to how to answer Question 2.1.2; they have to complete a table which provides structure for answering this part of the question. The table has clear headings for each column and is 'populated' with three alloys. The statement that alloys combine two or more metals should help candidates to recognise that they have to provide examples of more than one metal for each of the three alloys **(stimulus)**.
- To answer Question 2.1.1 candidates need to write the names of any three metals for 3 marks. So, the mark allocation and marking for question 2.1.1 is straightforward (3 marks for 3 names). The marking guidelines make provision for six possible answers. This straightforward response therefore makes the **expected response** for Question 2.1.1 to be easy hence it requires recall. To answer question 2.1.2 candidates have to write the names of metals in the relevant column on the table. Seven marks are allocated for seven answers/metals. What makes the expected response for Question 2.1.2 moderately difficult is that it is not clear from the mark allocation or the table shown on the examination paper how many metals candidates need to list in their response for each of the three metals and therefore how many marks are allocated per metal. This aspect makes the expected response for Question 2.1.2 moderately difficult **(expected response)**.

These questions are thus moderately difficult with regard to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

2.1.1 Non-ferrous metals used in farms:

- Copper. √
- Lead. √
- Tin. √
- Aluminium. √
- Zinc. √
- Brass. √ (Any 3) (3)

2.1.2

ALLOY	**METALS**
(a) Stainless steel	Manganese√, Chromium√, Nickel√ (3)
(b) Brass	Copper√, Tin√ (2)
(c) Solder	Lead√, Tin√ (2)

Example 2:

Question (6.2, 2013, Agricultural Technology):

Choose a word/term from COLUMN B that matches a description from COLUMN A. Write down only the letter (A – G) next to the question number (6.2.1 - 6.2.5) in the ANSWER BOOK, for example 6.2.6 H.

COLUMN A	COLUMN B
6.2.1 Ditches are dug at regular intervals to a suitable depth to remove free water from waterlogged soil. 6.2.2 The bottom of the trench is loosely packed with large stones, covered with smaller stones and finally with soil. 6.2.3 The waste-water management system that uses biological principles to break down the waste. 6.2.4 The lateral drain runs into the main drain at an angle of about 45 degrees. 6.2.5 The opening of the drain should be covered with this.	A stone drain B septic tank C herringbone drain D sieve E open drain F manhole G tile drain 5 x 2 = **(10)**

Discussion:

This question is classified as moderately difficult for the envisaged Grade 12 candidate because:

- Water management and drainage systems are challenging topics for the envisaged Grade 12 candidate. Responding to the question requires a sound knowledge and understanding of 'drainage systems' which is a key topic in the prescribed curriculum and a common topic in the field of

agriculture. The content and concepts such as herringbone drain, water logging, and manhole are moderately difficult for the envisaged Grade 12 candidate **(content)**.

- The task entails choosing the term or phrase in column B that matches the description in column A. Candidates have to read and understand all five descriptions provided in column A and then recognise the correct term or phrase for each description from the seven options provided in column B. They only need to write the letter (A-G) next to the correct question numbers. However, to work out each answer, candidates have to 'unravel' and understand a fair amount of information to distinguish between each of the descriptions provided. This factor makes the task moderately difficult rather than easy **(task)**.
- This type of matching question often occurs in examination papers, and the format should therefore be entirely familiar to Grade 12 candidates. The terms provided in column B of the table namely, stone drain; septic tank; herringbone drain; manhole and tile drain should all be familiar to Grade 12 candidates. What makes the stimulus material moderately difficult for the envisaged Grade 12 candidate is that the number of terms provided in column B of the table exceeds the number of descriptions provided in column A. Having terms which are distracters in column B raises the level of difficulty **(stimulus)**.
- To answer the question candidates need to write down the letters A-G next to the corresponding question number in their answer book. What makes the expected response moderately difficult is the fact that 10 marks are allocated for five correct responses. Each sub-question counts for two marks. Candidates can thus lose 2 marks for an incorrect answer. Furthermore, if they get one answer incorrect, they are likely to have at least two incorrect letters next to question numbers (unless they repeat letters as answers). Thus, it is moderately difficult for the envisaged Grade 12 candidate to attain all 10 marks. **(expected response)**

The question is thus moderately difficult in terms of the content, task, stimulus and expected response.

Memorandum/Marking guidelines

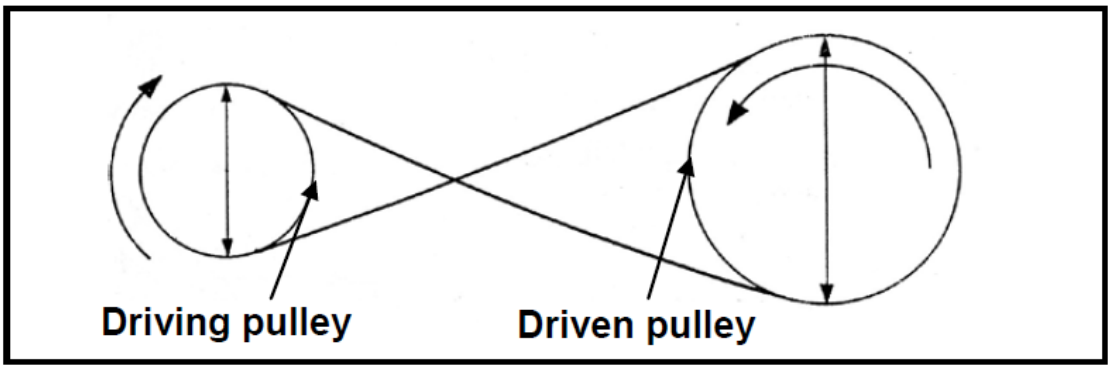
6.2
6.2.1 E √√ (2)
6.2.2 A √√ (2)
6.2.3 B √√ (2)
6.2.4 C √√ (2)
6.2.5 D √√ (2)

Example 3:

Question (5.4, 2012, Agricultural Technology):

A farmer wants to pump water from a river with an electrical motor and a centrifugal pump. The diameter of the pulley on the motor is 200mm and the r/min is 1500. The speed of the centrifugal pump, as indicated on the manufacturer's label, is 3000 r/min.

FIGURE 5: PULLEY ON A CENTRIFUGAL PUMP



5.4.1 Calculate the diameter of the pulley on the pump for optimal efficiency.

Use the following formula:

Na x Da = Ng x Dg

Show ALL calculations. (3)

Discussion:

This question is classified as moderately difficult for the envisaged Grade 12 candidate because:

- The question requires knowledge of an electrical motor and knowledge of a centrifugal pump and the concept of 'diameter'. By its nature this topic is moderately difficult for the envisaged Grade 12 candidate. All Grade 12 candidates should be familiar with the formula for calculating the diameter of the pulley on the pump for optimal efficiency; however, the application of the content into the formula makes the question to be moderately difficult. The candidates are also expected to know what the acronyms (i.e. Dg; Na; Da and Ng) in the formula represent **(content)**.
- The source material for this question consists of: a) short introductory paragraph explaining the context of the problem; b) a simple diagram headed 'Pulley on a centrifugal pump' showing the driving and driven pulley; and c) the question itself. The introductory paragraph a) makes it clear that the calculation required relates to using electrical motor and centrifugal pump to pump water from a river. The details provided in the introductory paragraph are neither easy nor difficult as it consists of technical terms and figures. Candidates will not find it easy to make sense of the diagram b) as it is complicated by the arrows which need to be carefully studied by the candidate before attempting the question. Candidates will also find part c) of the question to be moderately difficult because to calculate is not an easy task. The question provides the formula for calculating the diameter of the pulley on the pump for optimal efficiency so candidates do not have to decide for themselves which formula they should use. (If the formula was not provided the question would be difficult). The abbreviations Na, Da, Ng and Dg in the formula should all be familiar to Grade 12 candidates. The source material is moderately difficult for the envisaged Grade 12 candidate to read and understand **(stimulus)**.

- The task of calculating the diameter of the pulley on the pump for optimal efficiency using the formula provided is moderately difficult for the envisaged Grade 12 candidates. They have to select and substitute the appropriate figures based on information in the introductory paragraph. In other words, they have to read and grasp the meaning and relevance of the information provided in the opening paragraph, and decide for themselves which figures (information from the text) to insert in which places in the formula. They then have to calculate the diameter of the pulley for optimal efficiency. The term optimal efficiency is not familiar to Grade 12 learners and therefore make the question moderately difficult. This calculation involves three distinct steps. First, they must write down the correct formula. Second, they have to substitute the formula with correct figures extracted from the question. Thirdly, they must calculate by multiplying and dividing the figures and come up with the correct answer and correct units in millimetres **(task)**.
- 3 marks are allocated for this question. According to the memorandum, candidates must show all three steps involved in calculating the diameter of the pulley. However, candidates may not realize this requirement as it is not explicitly stated in the instructions for the question; they may only show their final answer or partial calculations. Also, if they get the answer wrong in the first step, then subsequent calculations will also be incorrect and they will lose marks (according to the marking memo). Thus, the envisaged Grade 12 candidate will find it moderately difficult to obtain full marks **(expected response)**.

The question is moderately difficult in relation to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

5.4.1 Calculations

Na x Da = Ng x Dg

$$Dg = \frac{Na \times Da}{Ng}$$

$$= \frac{1500 \times 200}{3000}\surd$$

= 100 mm√ (3)

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

Example 1:

Question (5.5, 2011, Agricultural Technology-Adapted):

Comment on the role of computers and satellite-positioning systems in modern combine harvesters. (4)

Discussion:

This question is classified as difficult for the envisaged Grade 12 candidate because:

- The question assesses more than one knowledge element. To answer the question, candidates need to have knowledge of computer systems, satellite-positioning systems, and modern combine harvesters. They also need a good understanding of how the two systems work in modern combine harvesters. These are complex concepts which the envisaged Grade 12 candidate finds difficult to understand. Few commercial farmers in South Africa own and use modern combine harvesters, so the envisaged Grade 12 candidate is also unlikely to have had any practical exposure to such systems **(content)**.
- The question is clear but contains a number of specialized technical terms such as 'satellite-positioning systems' and 'modern combine harvesters'. The action verb 'comment' could be misleading; candidates may not realise that they have to make a critical judgement and evaluate the role of the two systems in relation to modern combine harvesters **(stimulus)**.
- The task involves understanding the question properly and working out what is required. In order to comment on the role of computers and satellite-positioning systems in modern combine harvesters, candidates need to make a judgment. They also have to transfer ideas and knowledge from one context and use it in another. They have to integrate a number of knowledge elements to respond appropriately. Thus, the task is deemed difficult **(task)**.
- Only 4 marks are allocated for the question. Candidates have to condense what could be a long answer into four sentences, making sure that their answer contains relevant information. According to the memorandum candidates have to highlight issues of yield, spotting problems, identifying nutrient deficiencies and identifying problem areas in maize fields. The envisaged Grade 12 candidate will find it difficult to attain all four marks allocated. Marking an evaluation questions such as this one is demanding for markers as well as they have to assess the relevance and logic of what each candidate writes **(expected response)**.

The question is thus difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

5.5 Role of computers and satellite-positioning systems in modern combine harvesters:

- Computers help to determine the yield on each specific spot on the land. √
- Computers help you to spot problems in advance in the mechanics of the harvester. √
- Helps to identify plant nutrient deficiencies on the land. √
- Helps to identify problem areas in your maize field. √ (4)

Example 2:

Question (5.6.3, 2013, Agricultural Technology) - Adapted:

5.6.3 Recommend FIVE safety measures that a farm worker should consider when working with a hammer mill. (5)

Discussion:
This question is classified as difficult for the envisaged Grade 12 candidate because:

- The question assesses more than one knowledge element. To answer the question, candidates need to have knowledge of farm tools, implements and equipment. They also need a good understanding of how the hammer mill as a system works in modern agriculture. The hammer mill is one of the complex concepts which the envisaged Grade 12 candidate finds difficult to understand. The content regarding hammer mill also consists of technical terms such as 'rotor', 'safety gear', 'spark', 'explosion'. Not all commercial farmers in South Africa own and use hammer mills, so the envisaged Grade 12 candidate is also unlikely to have had any practical exposure to such an operating system **(content)**.
- The question is clear but contains a number of specialized technical terms such as 'safety measures' and 'hammer mill'. The action verb 'recommend' could be misleading; candidates may not realise that they have to make critical decisions in order to recommend the desired safety measures **(stimulus)**.
- The task involves understanding the question properly and working out what is required. In order to recommend 5 safety measures that a farmer should consider when working with a hammer mill, candidates need to make an informed judgment. They also have to transfer ideas and knowledge from one context and use it in another. They have to integrate a number of knowledge elements to respond appropriately. Thus, the task is deemed difficult **(task)**.
- Only 5 marks are allocated for the question. Candidates have to condense what could be a long answer into five sentences, making sure that their answer contains relevant information. The envisaged Grade 12 candidate will find it difficult to attain all five marks allocated. Marking an evaluation question such as this one is demanding for markers since they need to assess the relevance and logic of what each candidate writes **(expected response)**.

The question is thus difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

5.6.3 Safety measures when working with a hammer mill.

- Do not work on the machine while it is still in motion. √
- Ensure that there are no loose objects lying inside the machine when starting it. √
- Wear safety gear. √
- Do not use the machine when the rotor is out of balance. √
- Driving mechanism must be screened off. √
- Use in a well-ventilated area. √
- Small pieces of scrap metal must be kept away from the fodder. √
- It can cause a spark, which can start an explosion. √ (Any 5) (5)

Example 3:

Question (2.1, 2013, Agricultural Technology):

Fires on a farm can be very dangerous. Safety precautions and preventative measures are therefore very important.

FIGURE 7: EXTINGUISHING UNWANTED FIRES

2.1.1 Briefly discuss EIGHT measures to prevent unwanted fires on a farm. (8)
2.1.2 Explain the safety measures that should be kept in mind when using fire extinguishers. (5)

Discussion:

This question is classified as difficult for the envisaged Grade 12 candidate because:

- The concept of 'unwanted fires' is a difficult one for the envisaged Grade 12 candidate to understand because to discuss goes beyond the simple recall, and involves organizing facts. Candidates need to have a sound understanding of the principles and procedures associated with dealing with unwanted fires. For example, they need to know and understand that unwanted fires can easily be caused by hazardous areas including poor electrical installation. Candidates need to have a sound understanding of how fire extinguishers work and how to use them properly. The envisaged Grade 12 candidate finds understanding the safety measures involved in using fire extinguishers difficult. Fire extinguishers are not readily available, or are not in good working condition, in most schools in the country. Therefore, candidates rely on theory at the expense of practical understanding **(content)**.
- The stimulus material comprises a) a short text of two sentences, b) a photograph clearly headed 'Extinguishing unwanted fires' and c) the two questions. The opening text a) does not contain any terms which would be unfamiliar to Grade 12 candidates. It simply alerts them to the fact that the question is about fire safety measures and fire preventative measures. The photograph b) shows a person trying to put out a fire by using a fire extinguisher. The photograph is somewhat indistinct/blurry and the context shown does not appear to be that of a farm. But then candidates do not

need to refer to this photograph. Its function is illustrative; they do not have to interpret the picture to answer either of the questions. With regard to the questions, 2.1.1 explicitly tells them to discuss **8** preventative measures. Question 2.1.2 does specify 5 safety measures to be provided hence the mark allocation of 5 marks signals that 5 measures are required. The vocabulary and terms used in the two questions (e.g. 'preventative', 'measures', 'fire extinguishers') should all be familiar to the envisaged Grade 12. **(stimulus)**.

- The task in 2.1.1 is to provide 8 measures to prevent fires on farms. In 2.1.2 the task is to provide 5 safety measures to consider when using fire extinguishers. One difficulty in both tasks is the high number of measures required for each aspect. The envisaged Grade 12 will struggle to think of sufficient measures. Candidates have to write roughly 8 sentences to answer 2.1.1 and 5 sentences to answer 2.1.2. The envisaged Grade 12 candidates find it difficult to write extended text using their own words **(task)**.
- 8 marks are allocated for 2.1.1 and 5 marks are allocated for 2.1.2. According to the memo 1 mark is awarded for each preventative measure provided in part i) and 1 mark is awarded for each safety measure provided in 2.1.2. As one mark is allocated for each correct answer, the marking allocation is straightforward but the envisaged Grade 12 candidate will find it difficult to provide enough relevant information to attain high marks. Markers will need to assess the relevance and logic of what each candidate writes as each answer will differ. For instance, one safety measure is that: Only tackle a fire in its very early stage. Some candidates may simple write: tackle fire early or fight the fire early enough, etc. These aspects make the expected response difficult. However, the action verbs, 'discuss' and 'explain' could be misleading if, according to the memo, what candidates really have to do is provide or list preventative measures for fires on farm in 2.1.1 and list safety measures for using fire extinguishers in 2.1.2 **(expected response)**.

The question is thus difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

2.1.1 Preventing unwanted fires

- Isolate all sources of ignition. √
- Extinguishers in hazardous areas. √
- No smoking in hazardous areas. √
- Exits clearly marked in hazardous areas. √
- Proper electrical installation. √
- Flammable materials stored safely. √
- Fire emergency numbers listed near telephone. √
- Emergency fire plan posted. √
- Make use of fire breaks. √ (Any 8) (8)

2.1.2 Safety measures when using fire extinguishers

- Only tackle a fire after the alarm has been raised and it is safe to do so. √
- Ensure you are accompanied when you fight a fire or go to investigate, never do it alone. √
- Only tackle a fire in its very early stage. √
- Put your safety and that of others first, no heroics! √
- Only use an extinguisher if you are sure of how to use it properly. √
- Do not bold the horn on a CO2 extinguisher - it will be very cold. √

(Any 5) (5)

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

Note:
During the development of the exemplar book some subject specialists argued that there is a fine 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 (1, 2015 June, Agricultural Technology- New question):

Sprinkler irrigation is one of the most commonly used methods in the commercial farming industry. The sprinkler has a spray nozzle which is normally fitted to an overhead irrigation system. The sprinkler head of a suppression sprinkler system is attached to the ceiling with the top of the head facing down.

Recommend the mechanical aspects which are essential to consider when purchasing an irrigation sprinkler system. (3)

Discussion:

This question is classified as very difficult for the envisaged Grade 12 candidate because:

- The content on spray nozzle and suppression sprinkler systems is complex and not familiar to Grade 12 candidates. The concepts mentioned are difficult to understand and therefore makes the question very difficult. Candidates also need to know and understand the mechanical aspects which are essential for an effective irrigation sprinkler system. These mechanical aspects are extremely abstract and highly technical. The knowledge assessed is thus very difficult for the envisaged Grade 12 candidate **(content)**.
- A variety of elements make the stimulus very difficult to interpret. The opening paragraph that serves as source material is complex and the envisaged Grade 12 candidate will find it very difficult to follow. The text also includes a number of unfamiliar scientific and technical terms such as 'spray nozzle', 'overhead irrigation system' and 'mechanical aspects' which will all be unfamiliar to the envisaged Grade 12 candidate **(stimulus)**.
- To answer this question, candidates have to 'recommend' at least three mechanical aspects that should be taken into account when purchasing an irrigation system. The task of 'recommending' is cognitively demanding for the envisaged Grade 12 candidate particularly because the question asks for certain aspects of irrigation systems which are not taught in the classroom. They have to write at least 3 sentences using their own words to make recommendations **(task)**.
- Three marks are allocated for this question. By implication, candidates have to identify three important mechanical aspects for a sprinkler system to be effective. According to the memorandum 1 mark is allocated for each appropriate mechanical aspect which is not part of the learners' notes or textbook **(expected response)**.

The question is thus very difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

1. There is no correct response for this question. The question was purposely formulated to be very difficult for the Grade 12 Agricultural technology learner.

   The introductory statement is complex and abstract such that the Grade 12 learner will not comprehend what the question wants.

   The question further asks mechanical aspects which are not part of the Grade 12 curriculum in this subject.

Example 2:

Question (2, 2015 June, Agricultural Technology-New question):

Indicate whether each of the descriptions in COLUMN B applies to **A ONLY, B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN A. Write **A ONLY, B ONLY, both A**

and B or **none** next to the question number (2.2.1 to 2.2.5) in the ANSWER BOOK, for example 2.2.6 B only.

Example: 2.2.6

COLUMN A		COLUMN B
A:	John Deere	Designer of three-point mechanism of tractor
B:	Harry Ferguson	

Answer: 2.2.6 B only

COLUMN A			COLUMN B
2.2.1	A	Bacteria	Septic tank system should always contain
	B	Yeast	
2.2.2	A	500 mm x 600 mm	Prescribed size for a warning sign in an electric fence
	B	100 mm x 200 mm	
2.2.3	A	No fuel costs	Advantages of alternative energy sources
	B	Low maintenance costs	
2.2.4	A	Buildings	Floating or working capital
	B	Dams	
2.2.5	A	increase corrosion	The function of grease in the moving joints of implements is to…
	B	decrease friction	

(5 x 2) = (10)

Discussion:

This question is classified as very difficult for the envisaged Grade 12 candidate because:

- Candidates need to know about septic tanks and whether bacteria and/or yeast are important for their functioning. They need to know the correct size for a warning sign on an electric fence. Electric fences are not an easy topic and require a good understanding of all the aspects related to it. Candidates need to have a sound understanding of alternative energy sources. While candidates may know alternative energy sources, they always struggle to understand the specific advantages. Candidates need to understand capital and be conversant with the types of capital in this case. Candidates need to understand bronze and materials which are compatible to bronze. The main difficulty about this question is the fact that content is brought from different parts of the curriculum which makes the question very difficult **(content)**.
- The instructions for this question are very complex. Candidates have to 'navigate' their way through the instructions in order to understand what to do in order to answer the questions. This is not the usual matching type question where always one answer is correct **(stimulus)**.
- To answer each sub-question, candidates have to choose one of four possible answers, A only, B only, both A and B or none. The difficulty in the task lies in understanding the terms and descriptions and determining the correct option for each question. This question is not used in the Assessment Guidelines of Agricultural Technology which makes the question to be very difficult **(task)**.

- Ten marks are allocated for this question. There are five sub-questions and each one counts for 2 marks. The difficulty of the question is the fact that candidates will always have to choose one correct answer out of four. This difficulty will promote learners to resort to guessing instead of thinking critically before choosing the correct answer. The expected response is therefore easy to write. Candidates can only lose a maximum of 2 marks for each incorrect answer. The mark allocation is thus straightforward and the expected response is easy to mark as there is only one correct answer for each sub-question **(expected response)**.

The question is thus very difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

2.2.1 A Only. √√
2.2.2 B Only. √√
2.2.3 BOTH A and B. √√
2.2.4 NONE. √√
2.2.5 B Only. √√

Example 3:

Question (3, 2015 June, Agricultural Technology- New question):

The Power Take-off Shaft, usually called the PTO, provides us with a means of driving machines that are being towed by the tractor.

Identify all machines that are power driven and motivate the reasons for shafts to have six splines cut around the periphery. (5)

Discussion:

This question is classified as very difficult for the envisaged Grade 12 candidate because:

- The Power Take Off Shaft is covered in the CAPS for Agricultural Technology under the section '*Tools, implements and equipment*', but it is included for enrichment purposes rather than for examination purposes. Candidates need advanced knowledge of the finer details of the Power Take-off Shaft as well as **all** machines that are power driven. The topic is too broad for all the power-driven machines to be understood by an envisaged Grade 12 candidate. The content and concepts involved are very difficult for the envisaged Grade 12 candidate **(content)**.
- The stimulus consists of an opening statement followed by a question. A variety of elements make the stimulus very difficult to interpret. Some of the scientific and technical terms used would be very unfamiliar and confusing to the envisaged Grade 12. For example, terms such as 'power driven'; 'means', 'shaft', 'splines' and 'periphery'. The opening statement and the question itself are very technical and difficult to 'unpack'. The stimulus is very difficult for the envisaged Grade 12 candidate to interpret and understand **(stimulus)**.
- The task is to identify **all** machines that are power driven and provide reasons why the shafts need six splines cut around the periphery. To answer the question, candidates first have to make sense of and understand the complex opening statement and work out exactly what the question is asking. The task goes beyond describing the Power Take-off Shaft; they have to evaluate the effectiveness of power driven machines in general and then make a judgement as to why the shafts of *all power-driven machines* need six splines cut around the periphery. Their judgements have to be based on external criteria; they have to draw on and apply their knowledge and understanding of the principles underpinning the design of power driven machines and their shafts. They have to write extended text using their own words and background knowledge. This task is a very difficult for the envisaged Grade 12 Agricultural Technology candidate **(task)**.
- 5 marks are allocated for this question without a clear indication of how many marks are allocated for identifying power driven machines and reasons provided. The answers to the question are wide ranging. According to the memorandum one mark will be allocated for every reason provided by the candidate. The envisaged Grade 12 candidates will have difficulty in obtaining the marks allocated for this question. Marking the question will be demanding as candidates' responses will differ and markers will need to interpret and evaluate the logic of what each candidate writes. These aspects make the expected response very difficult **(expected response)**.

The question is thus very difficult in relation to all four sources of difficulty outlined in the framework.

Memorandum/Marking guidelines

Examples of machines that are power driven are:

- Mowers. √
- Balers. √

- Combines. √
- Potato harvesters. √
- Manure spreaders. √

There are two sizes of PTO shafts. These are either category 1 which is 34 mm diameter or category 2 which is 44 mm diameter √√. The categories relate to external sizes of the shaft√. The shafts have six splines cut around the periphery and rotate in a clockwise direction when viewed from the rear. (Any 5) (5)

9. Concluding remarks

This exemplar book is intended to be used as a training tool to ensure that all role players in the Agricultural 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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