



COUNCIL FOR QUALITY ASSURANCE IN GENERAL AND FURTHER EDUCATION AND TRAINING

**Exemplar Book on Effective Questioning
Agricultural Sciences**

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 Sciences 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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This exemplar book was prepared by Mr Thebeyamotse Tshabang.

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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 Sciences 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 Sciences 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 Sciences 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 Sciences 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 Sciences 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

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

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

	L1 Lower Order	L2 Middle Order	L3 Higher Order
	Knowledge	Comprehension & Application	Analysis, Synthesis and Evaluation

Source: CAPS (DBE, 2011a, p.58)

To facilitate reading of this section, each of the above cognitive demand levels in the Agricultural Sciences Taxonomy is explained, and the explanation is followed by at least **three** examples of questions from previous Agricultural Sciences 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 Sciences 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 4).

Note:

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

TABLE 2: EXAMPLES OF QUESTIONS AT LEVEL 1: KNOWLEDGE

Example 1:

Question (4.5, 2011, November – P1):

Mites are closely related to ticks, but are much smaller and most cannot be seen by the naked eye. Mites are found on less hairy parts on the bodies of cattle, sheep, goats, pigs and horses.

- a) Give a reason from the above extract to prove that mites are external parasites. (1)
- b) Identify TWO non-ruminants in the extract that are affected by mites. (2)

Discussion:

The verbs 'give' and 'identify' are indicative that both questions involve low order cognitive processes. Furthermore, the questions require simple extraction of the related information from the given passage/leading statement. To answer the questions Grade 12 candidates need to retrieve basic information of what they have learnt in class on the animal health and classification but again the response for both questions are given on the passage/leading statement.

Memorandum/Marking guidelines

a) Reason to prove that mites are external parasites

- Mites are found on less hairy parts of the body of cattle, sheep, goats, pigs and horses/Mites related to ticks. ✓ (1)

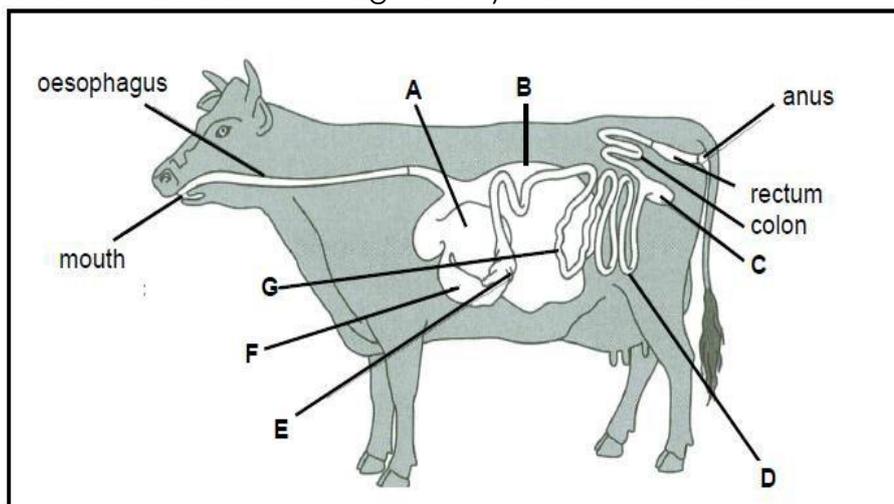
b) Two non-ruminants affected by mites

- horses ✓
- pigs ✓ (2)

Example 2:

Question (2.1, 2012, November-P1):

The diagram below illustrates the digestive system of a ruminant.



- a) Identify the parts labelled A, B, and F shown on the diagram above. (3)
- b) State TWO ideal conditions required for microbial activity in the ruminant stomach. (2)

Discussion:

The question verbs 'identify' and 'state' indicate that these are low order questions. Question a) requires candidates to identify the parts labelled and that will need candidates to locate and retrieve required information from their memories. The diagram provided will facilitate quick and simple connection of various parts of the alimentary canal of ruminants which will make it easier for them to respond appropriately to the question. Question b) requires candidates to recall basic information related to rumen microbes which would be easier to retrieve from their memories.

Memorandum/Marking guidelines

a) THREE labelled parts

- A /reticulum/honeycomb/net stomach. ✓
- B /rumen/large stomach. ✓
- F/omasum/leaf stomach. ✓

(3)

b) TWO ideal conditions for microbial activity

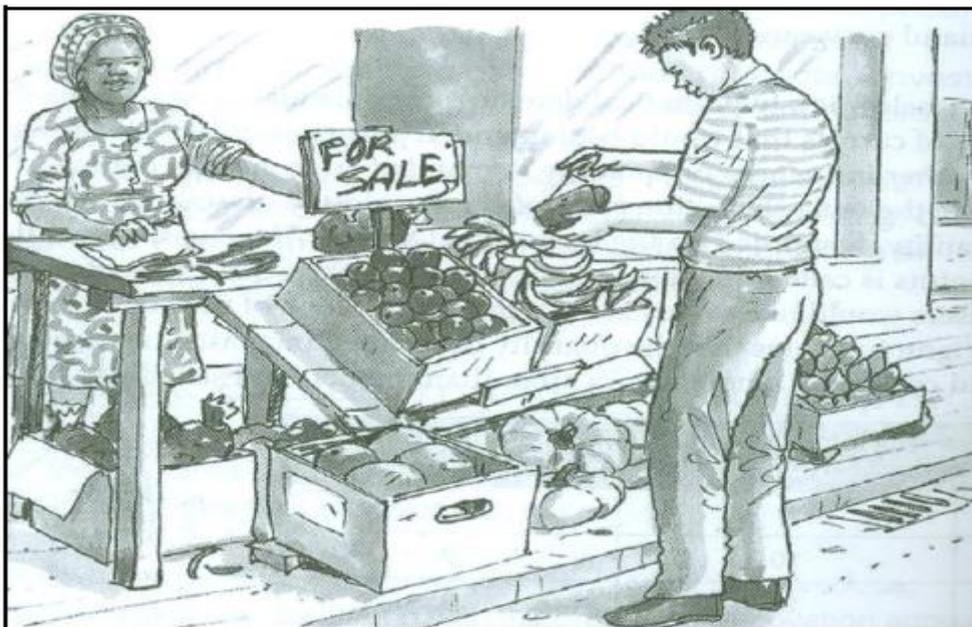
- suitable/optimal/moderate/favourable temperature/ $\leq 38^{\circ}\text{C}$ to 42°C . ✓
- sufficient mineral nutrients/phosphorus/cobalt. ✓
- sufficient nitrogen. ✓
- easily digestible carbohydrates. ✓
- a slightly acid medium/suitable pH (5,5 to 6,5). ✓
- moist. ✓
- anaerobic. ✓
- regular intake of food/nutrients. ✓
- removal of waste products. ✓

(Any 2) (2)

Example 3:

Question (2.3, 2012, November - P2):

The picture below shows a street vendor selling agricultural products.



a) Identify the marketing system illustrated in the picture above. (1)

b) The marketing system above is exposed to some risks. State TWO possible risks of this type of marketing system. (2)

c) Name the THREE main disadvantages of the marketing system above. (3)

Discussion:

All the three question verbs 'name'; 'state' and 'identify' suggest that these are low order questions. This is a basic recall question. Grade 12 candidates should have learnt about systems of marketing. Candidates come into contact in most areas with vendors selling fruits and vegetables on the streets, which make it easier for them to relate and respond appropriately to the set questions. Candidates have to remember what they have learnt in class and in their real-life contacts with street vendors. The source material used does provide clues to the three questions asked. It also leads and channel candidates' thinking when responding to the set questions.

Memorandum/Marking guidelines

a) Marketing system

- Free marketing. ✓
- The vendor is selling directly to the consumer. ✓ (Any 1) (1)

b) TWO possible risks

- Theft/safety concerns. ✓
- Fluctuating prices/supply and demand. ✓
- Perishability. ✓
- Lack of storage. ✓
- Lack of transport. ✓
- Lack of market/product does not sell. ✓
- Weather conditions. ✓
- Regulatory changes. ✓
- Competition. ✓
- Health of vendor. ✓ (Any 2) (2)

c) THREE disadvantages of free marketing system

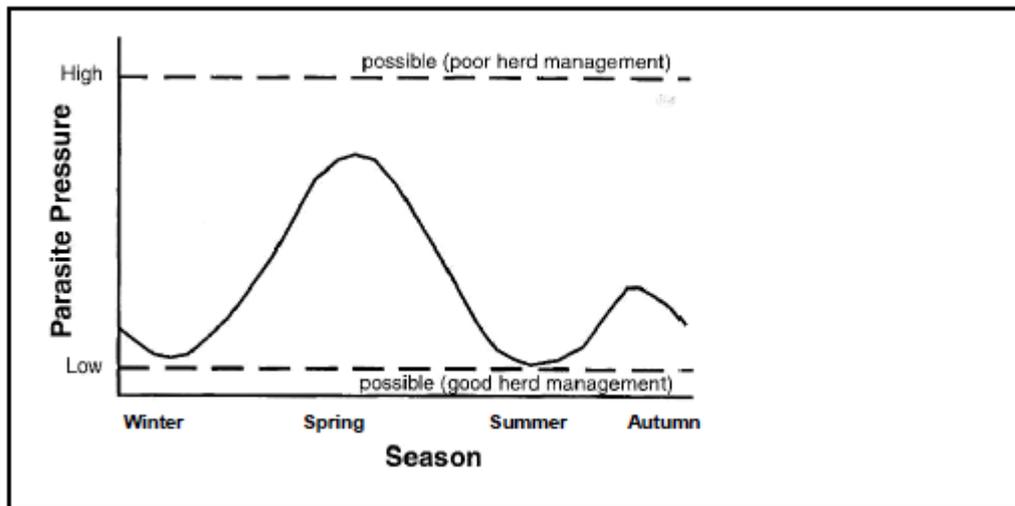
- Exploitation by consumers. ✓
- Price fluctuations. ✓
- Lack of cooperation between producers and consumers can lead to oversupply and lower prices. ✓
- Marketing costs are high. ✓
- Complicated system to manage. ✓
- Expert knowledge is needed for this marketing/highly specialised. ✓
- Producer spent more time on marketing. ✓
- Producer has less bargaining power. ✓
- Producer runs a greater risk. ✓
- Highly competitive. ✓ (Any 3) (3)

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

Example 1:

Question (4.5, 2010, November – P1):

The figure below indicates the seasonal trends in the occurrence of parasites that vary with regard to season and management.



- Name the season with the highest parasite pressure (infestation). (1)
- Give a reason for the high parasite pressure (infestation) during the season mentioned in QUESTION (a) above (2)
- Explain TWO good herd management practices that may lead to less parasite pressure (infestation). (4)

Discussion:

The candidates are required to study the graph and process the information provided in order to respond appropriately to the set questions. Question a) need candidates to 'identify' from the graph the season of high parasite infestation which can be easily identified from the graph (this question is lower order). However, question b) is related (linked) to question a) since candidates will have to provide reasons for their response in question a). This makes question b) medium order question to the candidates. The candidates will have to provide reasons based on what they have learnt in the classroom on animal health. Furthermore, question c) makes medium level cognitive demands on candidates. It requires them to 'explain' the good herd management practices. Candidates will have to retrieve such information from the knowledge they have learnt in class.

Memorandum/Marking guidelines

- Season with high parasite infestation** (1)
 - Spring. ✓
- Reason for high parasite infestation**
 - Poor herd management/conditions are suitable for multiplication of parasites. ✓✓
 - Environmental conditions are more favourable for the breeding of pests/ ✓✓ (Any 1) (2)

c) Good herd management practices

- Good nutrition. ✓
- Health programme/chemical control/biological control. ✓
- Avoiding wet places. ✓
- Rotational grazing. ✓

(4)

Example 2:

Question (3.1, 2010, November –P2:

Agricultural management can be defined as a comprehensive activity, involving the combination and coordination of human, physical and financial resources. These factors are combined in a way which produces a commodity or a service which is both wanted and can be offered at a price which will be paid. This process also includes making the working environment for those involved agreeable and acceptable.

- a) Discuss FOUR factors that need to be combined in the management of a farm. (8)
- b) Explain TWO external influences that may affect the farm as a business. (4)

Discussion:

The verbs 'discuss' and 'explain' suggest that both these questions are middle order questions. Both questions assess candidates' understanding and application of the farm management principles. Part a) is not merely a recall question since candidates are required to discuss factors to combine in farm management which are given already on the leading passage but will need candidates to demonstrate their understanding in combining those factors so as to make them work as a single unit. In discussing all the four factors candidates will have to show their understanding and application of the farm management concepts or principles. To explain the external influences on a farming business, Part b) will require the candidates to have a clear understanding of the farming business environment under which the farm operates. The candidates should have an idea of the issues occurring outside the farm which may affect the farm directly or indirectly in order to respond appropriately to the set question. Furthermore, the leading statement provides candidates with a clue on the agricultural management issues and farming business environment so as to channel candidates to respond to the question in a particular format so that deviation from the asked question is minimized. Therefore, both questions are classified as middle order questions.

Memorandum/Marking guidelines

a) Factors that need to be combined in farm management

- Production/physical resources/Environment/Land ✓: Natural resources such as land, minerals and water etc are utilized in the process of producing food. ✓
- Staffing/human resources / Labour ✓: Human resource especially labour is needed for food production. ✓
- Finances / Capital ✓: Capital aspects such as money, machinery etc are required for food production. ✓
- Marketing ✓: Produce from the farms are to be sold to consumers in a

formal or non-formal markets. ✓

(8)

b) External influences that may affect the farm as a business

- Political environment/politics. ✓
- Global economic environment/economy. ✓
- Social environment/society/Effect of HIV/AIDS/Culture /Religion/lifestyle choices. ✓
- Legal environment/law/legislation/justice. ✓
- Natural disasters/Extreme climatic conditions. ✓
- Profitability. ✓
- Ethics. ✓
- Environmental sustainability. ✓
- Competition from other sectors. ✓
- Technological forces. ✓

(Any 2) (2)

Example 3:

Question (2.3, 2010, November – P2):

A farmer in KwaZulu-Natal plans to plant 200 ha of sugar cane in the following year and therefore keeps record of marketing trends of sugar cane. The table below summarises the results that this farmer needs in the decision-making process.

	TIME (YEARS)			
	2005	2006	2007	2008
Quantity of sugar cane supplied (million ton)	180	170	200	220
Price per ton (R/ton)	450	500	650	720
Quantity of sugar cane demanded	230	210	175	165

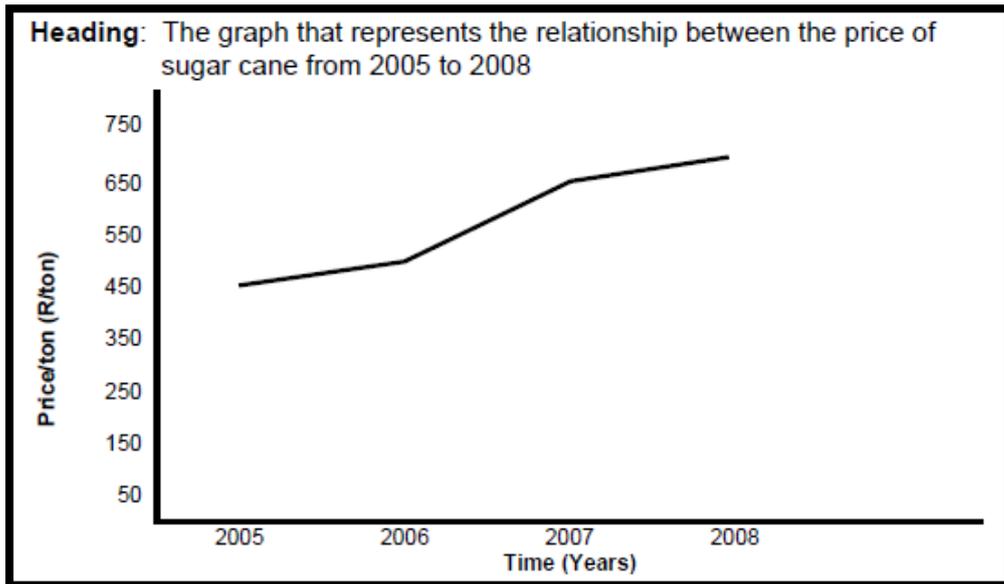
- a) Draw a line graph to indicate the changes in the price of sugar cane from 2005 to 2008. (4)
- b) Indicate the TWO factors that will possibly influence the price of sugar cane over a period of time by using the data which is supplied above. (2)

Discussion:

To answer these questions, candidates need to interpret and understand the data provided and use the data in a new situation. In question a) candidates have to draw a graph; they have to be able to plot the graph on non-graph paper which is more cognitively demanding to them. Plotting the graph requires candidates to indicate the changes in the price of sugar cane from 2005 to 2008 and have the correct x and y-axis for the data provided. This task is thus an example of application of data to plot a graph. For question b) candidates have to show their understanding of factors which influence pricing of product (sugar cane) and relate it with the given data on the table. This question is based on the interpretation of data from the graph.

Memorandum/Marking guidelines

a) Line Graph



Marking rubric

- Correct heading. ✓
 - Line graph used. ✓
 - Correct values. ✓
 - labelled Y & X-axes. ✓
- (4)

b) Factors influencing the price of sugar cane

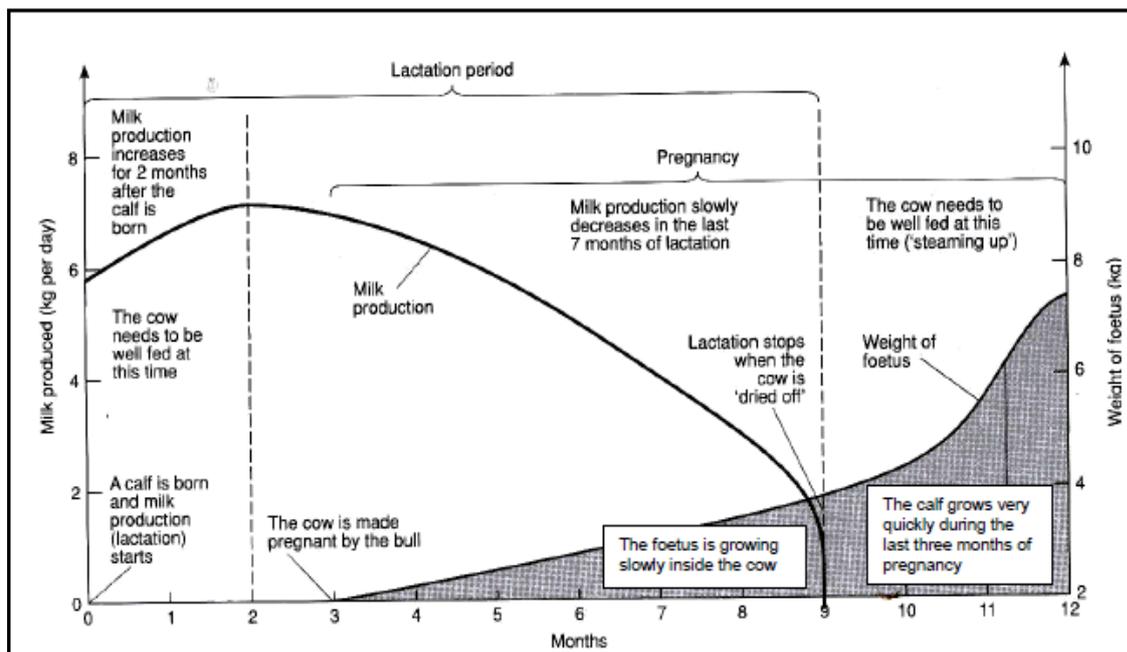
- Demand ✓
 - Supply ✓
- (2)

TABLE 4: EXAMPLES OF HIGHER ORDER QUESTIONS: LEVEL 3 – ANALYSIS, SYNTHESIS AND EVALUATION

Example 1:

Question (4.3, 2010, November– P1):

The graph below represents the annual reproductive aspects in the life of a dairy cow.



- List THREE activities that occur in the first two months after calving in the life of this cow. (3)
- Identify the month (indicated as 1 to 12) when this cow will be inseminated. (1)

Discussion:

All these questions require candidates to comprehend, apply, analyse and synthesise the data provided in order to respond correctly. In part a) candidates have to identify the activities or processes that occur in the cows' life. The action verbs are regarded as of low cognitive demand. But for candidates to spend such a huge time to analyse, synthesise and comprehend the data on the graph has increased the demand to high order on the candidate to identify all the activities occurring in the two months period of the cow's life. Doing this encompasses interpreting, analysing the graph and synthesising the information provided in order to respond appropriately to the question.

In part b), candidates are also expected to comprehend and synthesise the information provided for proper identification of the correct time for artificial insemination which will be demanding to the candidates. They need to evaluate the information given on the graph for them to provide the correct response to the set question.

Furthermore, the action verbs are of lower cognitive level but the analysis, synthesis, evaluation of the provided data qualifies these questions to be classified as high order questions based on the demand required from candidates. It has to be noted that such questions where the source material is packed data will demand more time for candidates to answer.

Memorandum/Marking guidelines

a) THREE activities that occur in the first two months after calving

- Milk production (Lactation) starts/Colostrum is formed. ✓
 - Milk production increases to peak production. ✓
 - Animal needs to be well fed/Feed consumption increases. ✓
 - Recovery of reproductive organs and glands/oestrus starts again. ✓
 - Metabolic state of animal changes ✓
- (3) (Any 3)

b) The month for correct insemination

- Month 2 or 3. ✓
- (1)

Example 2:

Question (2.2, 2013, March – P1):

The feeds below are available to compile a ration for farm animals

Feeds	Composition indicators (%)				
	DM	DP	TDN	Ca	P
Sunflower oilcake meal	89	31	69	0,5	0,8
Maize	85	10	90	0	0,3

- a) Draw a bar graph to compare the DM and TDN values of sunflower oilcake meal with those of maize. (6)
- b) Based on your response in QUESTION (a), deduce the feed that is most suitable for production. Motivate your answer. (3)

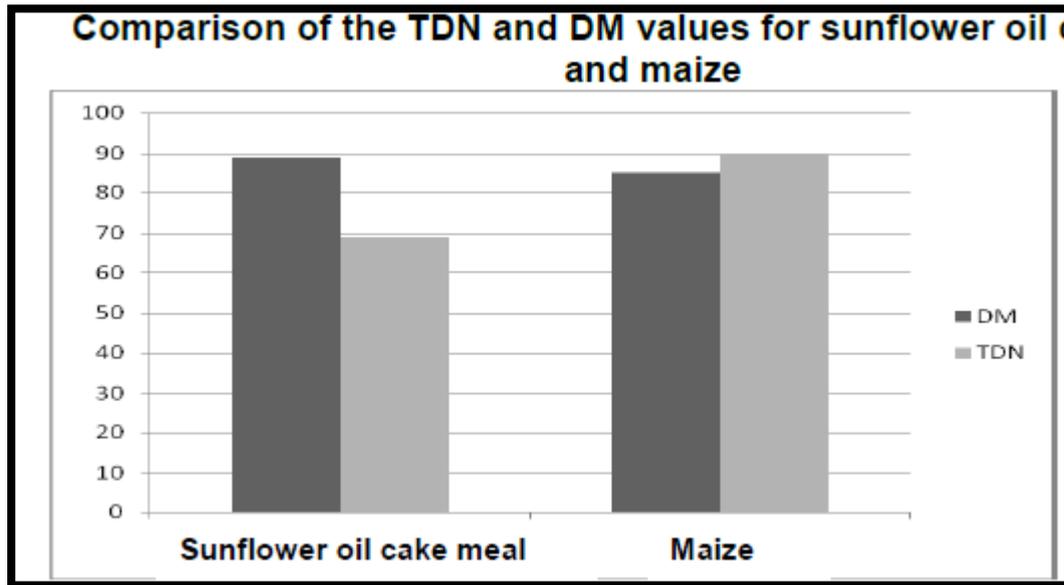
Discussion:

The action verbs 'draw', 'compare' and 'deduce' indicate that questions **a & b** are higher order questions. However, question a) requires candidates to draw and make a comparison of certain aspects indicated on the table which shows two tasks required at a given time on candidates to perform. The question is demanding because it requires candidates to draw a bar graph and plot the x and y-axis correctly using a non-graph paper for such an activity. It will be challenging to candidates to draw an appropriate bar graph on a proper scale on such non-graph papers.

Question b) requires candidates to make appropriate deductions and provide reasons based on their response in question a). The question demands candidates to make a comparative deduction. Candidates are also required to justify with appropriate reasons the suitability of the feed for production.

Memorandum/Marking guidelines

a) Bar Graph



Marking rubric

Bar graph. ✓

X-axis labelled. ✓

Y-axis indicated. ✓

Values plotted correctly. ✓

Correct heading. ✓

Units are indicated on the Y-axis. ✓

(6)

b) Feed suitable for production

- Sunflower oilcake meal. ✓

AND

- Has a narrow NR ratio. ✓
- NR is less than 1:6 which is the norm for a narrow margin. ✓

OR

- Has more protein/high % of protein/high protein content. ✓
- In relation to carbohydrates and fats. ✓

(3)

Example 3:

Question (3.4, 2013, March – P2):

The data below shows the income and expenditure of two poultry farmers involved in the laying-hen industry in South Africa over a period of six months.

FARMER A

EXPENDITURE	RAND	INCOME	RAND	Profit
Cost of layers	13500.00	Eggs	25 500.00	
Feed	9500.00	Sale of layers	6700.00	
Electricity, water and wages	6000.00	Sale of manure	5400.00	
Gas for heating	2100.00			
Egg trays	1200.00			
Veterinary care	800.00			
Maintenance				
TOTAL				

FARMER B

EXPENDITURE	RAND	INCOME	RAND	Profit
Cost of layers	13500.00	Eggs	25 500.00	
Feed	10500.00	Sale of layers	6700.00	
Electricity, water and wages	6000.00			
Gas for heating	400.00			
Electricity, water and wages	2100.00			
Egg trays	1200.00			
Veterinary care	600.00			
Maintenance				

a) Determine which poultry farm is more successful based on the data provided on the table above. Give a reason to support your answer. (4)

Discussion:

The question is classified as high cognitive demand question since it requires analysis and synthesis. To answer the question, candidates will have to understand and analyse both the data provided on the two tables for farmer A & farmer B.

Candidates will have to perform calculations on net profits for the production enterprise for farmers A & B. To arrive at the correct answer candidates require deep understanding of income and expenditures of the production enterprise. Furthermore, candidates are required to evaluate or make a judgment about the results so that they are able to determine the poultry farm that is profitable and provide a good reason for their response.

Memorandum/Marking guidelines

Net income

Farmer A: = R 4 100.00✓ (1)

Farmer B: = R- 2 100.00✓ (1)

- Farmer making more profit: Farmer A✓ (1)

Reason:

- Sells chicken litter/manure/generate an extra income. ✓
- Spends less money on feed than farmer B ✓

(Any 1) (1)

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 Sciences NSC examination **candidate**.
4. Question difficulty is determined using **a common framework** for thinking about question difficulty.
5. Question difficulty entails **distinguishing unintended sources of difficulty** or ease **from intended sources of difficulty** or ease.
6. Question difficulty entails identifying **differences** in levels of difficulty **within a single question**.

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

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

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

Note:

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

7.2 Question difficulty is assessed at four levels of difficulty

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

TABLE 5: LEVELS OF DIFFICULTY OF EXAMINATION QUESTIONS

1	2	3	4
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 (<i>extremely</i> high-achieving/ability students) to be discriminated from other high achieving/ability students).

Note:

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

7.3 Question difficulty is determined against the assumed capabilities of the ideal 'envisaged' Grade 12 Agricultural Sciences 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 Sciences 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 Sciences 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 graphophonetic/visual cues.
- **syntactic or organisational structure** – for example, sentence structure and length. For example, if learners are likely to be *familiar with the structure* of the 'text' or resource, for example, from reading newspapers or magazines, etc. 'texts' are *usually* easier than when the structure is unfamiliar.
- **literary techniques** – for example, abstractness of ideas and imagery – and **background knowledge required**, for example, to make sense of allusions.
- if the **context** is **unfamiliar** or remote, or if candidates do not have or are

not provided with access to the context which informs a text (source material, passage, diagram, table, etc.) they are expected to read, and which informs the question they are supposed to answer and the answer they are expected to write, then constructing a response is *likely* to be more difficult than when the context is provided or familiar.

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

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

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF STIMULUS DIFFICULTY

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

TASK DIFFICULTY

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

For example:

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

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

Questions that test specific knowledge are *usually* less difficult than **multi-step,**

multiple-concept or operation questions.

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

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

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

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

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

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

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

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

subject) or transform information to answer the question.

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

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF TASK DIFFICULTY

- Level of detail required in an answer is unclear.
- Context is unrelated to or uncharacteristic of the task than candidates have to do.
- Details of a context distract candidates from recalling or using the right bits of their knowledge.
- Question is unanswerable.
- Illogical order or sequence of parts of the questions.
- Interference from a previous question.
- Insufficient space (or time) allocated for responding.
- Question predictability or task familiarity. If the same question regularly appears in examination papers or has been provided to schools as exemplars, learners are likely to have had prior exposure, and practised and rehearsed answers in class (for example, when the same language set works are prescribed each year).
- Questions which involve potential follow-on errors from answers to previous questions.

EXPECTED RESPONSE DIFFICULTY

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

For example:

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

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

Some questions are more difficult/easy to mark accurately than others. Questions that are **harder to mark and score objectively** are *generally* more difficult for candidates than questions that require simple marking or scoring strategies on the part of markers. For example, recognition and recall questions are *usually* easier to test and mark objectively because they usually require the

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

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

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF EXPECTED RESPONSE DIFFICULTY

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

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

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

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

Note:

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

When considering question difficulty ask:

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

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

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

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

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

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

Note:

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

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

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

Note:

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

8. EXAMPLES OF QUESTIONS AT DIFFERENT LEVELS OF DIFFICULTY

This section provides at least **three** examples of questions from previous Agricultural Sciences NSC examinations (Table 7 to Table 10) categorised at each of the four levels of difficulty described in Section 7 (Table 5) above.

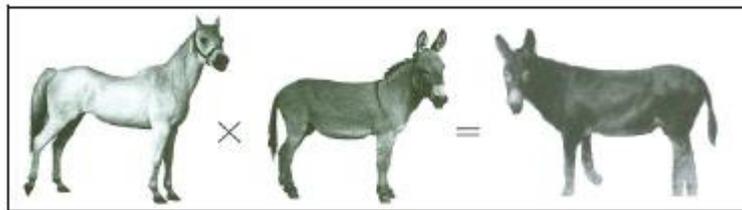
These examples were selected to represent the **best and clearest** examples of each level of difficulty that the Agricultural Sciences experts could find. The discussion below each example question tries to explain the reasoning behind the judgments made about the categorisation of the question at that particular level of difficulty.

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

Example 1:

Question (4.4, 2013, Nov –P2):

The diagram below shows a type of breeding system used by some livestock farmers.



- a) Identify the type of breeding system illustrated above. (1)
- b) Name the type of animal produced by the breeding system in QUESTION (a) (1)
- c) State TWO uses of the animal produced by this system of breeding. (2)

Discussion:

This question is likely to be easy for the envisaged Grade 12 candidate because:

- It assesses '**basic content**' or subject knowledge of animal breeding that all Grade 12 candidates should have learnt at Grade 10 Agricultural Sciences. Most of the candidates are expected to be familiar with the concept animal breeding which makes it easier for them to respond correctly to the set questions (**content**).
- The questions a), b) and c) are clearly phrased and straightforward with no hidden aspects which could confuse candidates. These questions do not contain any superfluous or unnecessary detail and the source material (diagram) used to stimulate their thinking is clear. Furthermore, nothing is found which could distract candidates from understanding what is required in responding to the set questions (**stimulus**).
- The **tasks are** very clear; the questions ask candidates exactly what is expected from them. These aspects: **a) identify, b) name** and **c) state** are required from candidates' knowledge. The questions are clear hence it would be easier for candidates to respond appropriately. Candidates should have been exposed to similar tasks and questions in lower grades (**tasks**).
- The mark allocations are straightforward. Question a) ONE mark is allocated for providing the correct breeding system. Question b) ONE mark is allocated for mentioning the end product of the crossing. Question c) TWO marks are allocated for stating the two uses of the animal (**expected response**).

This question is easy with regard to all four sources of difficulty

Memorandum/Marking guidelines

a) Breeding system

- Species crossing. ✓ (1)

b) Type of animal

- Mule. ✓ (1)

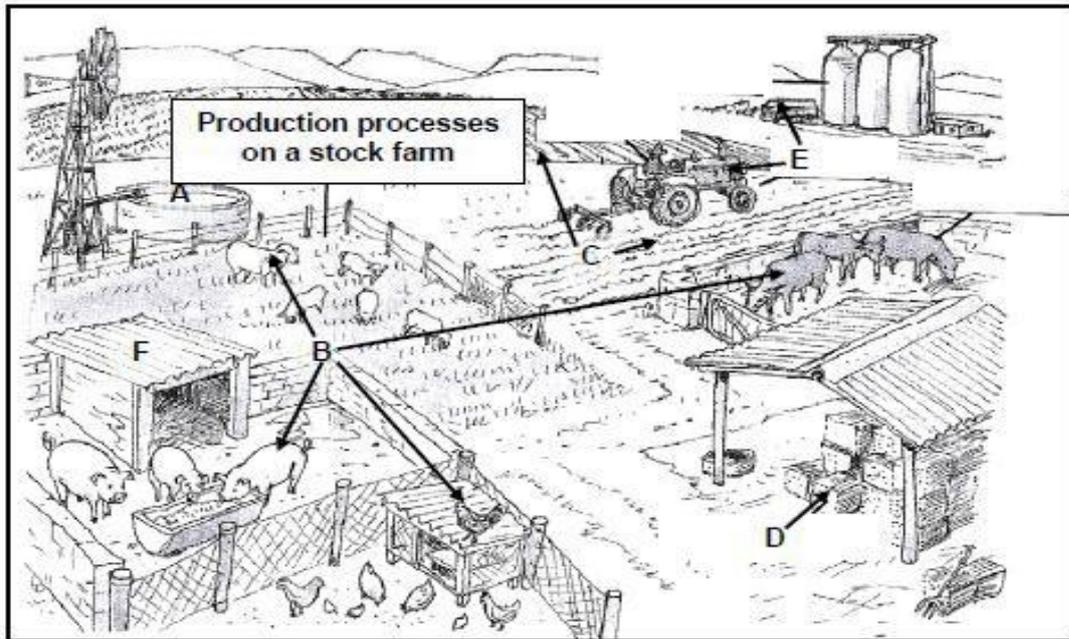
c) TWO uses of the mule in farming

- Used as draught animals for pulling implements/ploughing. ✓
- To carry loads. ✓ (2)

Example 2:

Question (3.4, 2010, Nov -P1):

The picture below represents some actions in the production process on a stock farm.



Use the picture above and indicate the letter (A – F) that represents the actions that are used in this animal production enterprise with regard to the following:

- | | |
|------------------------|-----|
| a) Storage of feeds. | (1) |
| b) Animal populations. | (1) |
| c) Planted pastures. | (1) |
| d) Water provision. | (1) |

Discussion:

These question is classified as easy for the envisaged Grade 12 candidate to answer because:

- The aspect of identifying various farming activities and infrastructure from the source material (picture) should be familiar and easier concept to Grade 12 candidates. They should have been exposed to various farming environments from the lower grades. Answering the question does not require specialized knowledge and therefore the candidates will be able to respond appropriately to the set question based on their past exposure to a farming setup (**content**).
- Candidates should easily be able to indicate various farming activities on infrastructures supplied in a farm setup. The task should be easy based on their past exposure to farming environments right from lower grades (**task**).
- The phrasing of the question is straight forward. The stimulus used does not have a lot of text for candidates to read. All the areas indicated in the picture are visible which makes answering this question easier to candidates (**stimulus**).
- The 4 marks allocated for the questions are straight forward. One mark each is allocated for writing the correct letter from the picture. Furthermore, it does not entail much writing (**expected response**).

This question is easy with regard to all four sources of difficulty.

Memorandum/Marking guidelines

Fodder flow programme:

- | | |
|-------|-----|
| a) D✓ | (1) |
| b) B✓ | (1) |
| c) C✓ | (1) |
| d) A✓ | (1) |

Example 3:

Question:

Question (2.3, 2012, November –P1):

Vitamin A is produced by ruminant animals such as cattle, sheep and goats from a pigment found in green grass and stored in the liver. When no green grass is available during the dry period, the animals will use the vitamin A stored in the liver. It is thus advisable to supplement it during winter in a summer-rainfall area.

[Source: Farming SA, September 2011]

- a) Indicate a season of the year when vitamin A is mainly supplemented and support your answer by referring to the data given in the passage above.

(2)

Discussion:

The question is regarded as easy question based on the following:

- The question tests a specific elementary knowledge in the subject. Question is simple and straight forward. The candidate will have to extract the information from the passage. Hence, the question is classified as easy (**content**).
- The passage provided is simple, short and easy to interpret as it only relates to vitamin A. It does not include any superfluous information. It contains simple words and phrases rather than specialized subject specific phraseology and terminology. The candidates should be able to extract the answers easily from the passage (**stimulus**).
- For this question, the candidates will have to find the answer directly from the passage. It is easier for the candidates to indicate the season of the year from the passage since it is not long and convoluted. The question is clear and unambiguous (**task**).
- The answers expected for this question are not long. Candidates are expected to find the answer of question a) from the passage given. The mark allocation is straightforward – for example, two (2) marks are allocated for two responses in the question (**expected response**).

This question is easy with regard to all four sources of difficulty.

Memorandum/Marking guidelines

a) Season for supplementing and reason

- Winter/dry season✓
- Green fodder (grass) that contain pigment (carotene) that can be transformed to vitamin A is not available in winter/dry season hence it is advisable to supplement this vitamin during winter✓

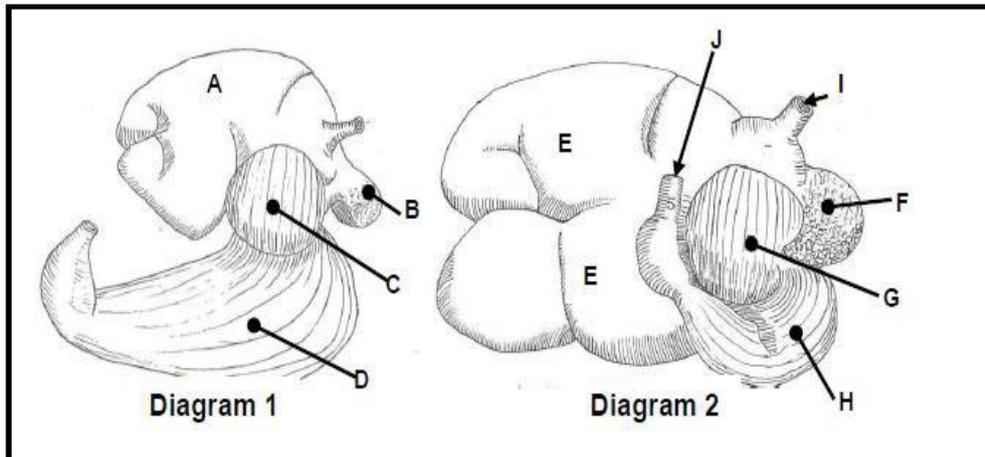
(2)

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

Example 1:

Question (2.1, 2009, November – P1):

The diagrams below represent the differences between two ruminant animals from the same species at different ages. The digestive processes in each of the digestive systems differ.



- a) Tabulate the labels A to D in Diagram 1 and pair them with similar structures labelled E to H in Diagram 2 in the digestive systems indicated above. (4)
- b) From the above diagrams, indicate the part that is most suitable for the digestion of crude fibre (cellulose). Explain your answer by referring to the adaptation of this organ for the digestion of cellulose. (4)

Discussion:

The two questions are regarded as moderate questions based on the following:

- The question tests application of basic knowledge taught in class. The topic on various alimentary canals of animals does pose a challenge to the envisaged Grade 12 candidate. Candidates will have to spend time and study the two diagrams properly in order to respond correctly to the set questions. Hence, the two questions content is classified as moderately **difficult content** for the envisaged Grade 12 candidate (**content**).
- Question is regarded as moderately difficult since the diagrams are clear with labels and not packed with unnecessary data. The diagrams are closely related but differ in that one is for a young ruminant and the other for an adult ruminant. The diagrams require a bit of study and interpretation prior to responding to the set questions (**stimulus**).
- The level of difficulty in the questions is moderate because it demands candidates to 'tabulate' and 'pair' the organs. It also demands that candidates 'explain' the organ adaptations for a specific task. Furthermore, the task requires a thorough tabulation of organs and explanation of the adaptation features (**task**).
- Four (4) marks are allocated for question a) for tabulating and pairing the organs. Question b) is allocated four (4) marks – the one mark is for

identifying the organ from the diagram and three marks for explaining the adaptation features of the identified organ. The question does not guide the candidates as to how much they should write in order to obtain the full 3 marks (**expected response**).

This question is moderate with regard to all four sources of difficulty

Memorandum/Marking guidelines

a) Similarities between diagram 1 and 2 structures

Diagram 1	Diagram 2
A	E✓
B	F✓
C	G✓
D	H✓

(4)

b) The adaptation of this organ for the digestion of cellulose

- Diagram 2/E/rumen/reticulo-rumen. ✓ (1)
- and**
- Rumen/reticulo-rumen is well developed and large (great volume). ✓
- to cater for the bulky and fibrous roughages. ✓
- formed like a fermentation organ or vessel. ✓
- and is ideal for microbe/bacteria/protozoa activity/cellulase secretion by microbes. ✓
- has a warm and moist environment/correct pH/optimum pH. ✓
- finger like projections in the wall of the rumen ✓ (Any 3) (3)

Example 2:

Question (2.4, 2010, November – P1):

You have been approached by a group of farmers who want to feed their lactating ewes some concentrate feed in addition to their normal grazing. The farmers say they can buy some maize and sunflower oilcake meal cheaply. You do some research and find out that maize has a crude protein content of 10,6% and sunflower oilcake meal has a crude protein content of 40%. These lactating ewes require 13, 4% crude protein in their concentrate.

Use the Pearson-square method to calculate the ratio in which maize and sunflower oilcake meal should be mixed to get to the required crude protein value for these lactating ewes. (5)

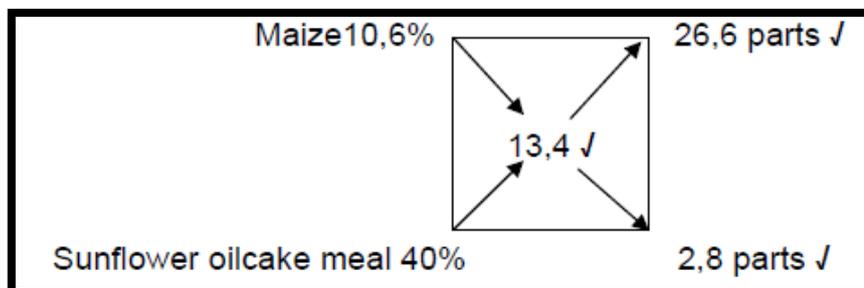
Discussion:

The question is regarded as moderately difficult question based on the following:

- Grade 12 candidates should know how to draw Pearson Square using two feeds. Candidates need to show understanding of the concepts and data to use on drawing the Pearson Square. The calculation aspects of the Pearson Square method can be a challenge to the envisaged Grade 12 candidate. Candidates are expected to comprehend and understand the concepts on calculation **(content)**.
- The source material comprises a short text and it provides data that must be used to answer the question. The source material has terminology such as 'concentrates', 'lactating ewes' and 'crude protein content' which are less complex concepts known to the envisaged Grade 12 candidate **(stimulus)**.
- The question requires the candidates to place the correct data on to the Pearson Square method in order to calculate the ratio. The question requires candidates to demonstrate how much of each feed should be mixed in the ration. Hence, this question will pose a challenge to the envisaged candidate based on procedure and process to follow **(task)**.
- The 3 marks are allocated for the drawing of Pearson Square and plotting of data in it. 2 marks are allocated for the correctness of calculations. Candidates may be penalized for not using appropriate processes and procedures in the calculation of the ratio **(expected response)**.

This question is moderate with regard to all four sources of difficulty.

Memorandum/Marking guidelines



Ratio: Maize: Sunflower oilcake meal = 26,6 ✓ : 2,8 ✓

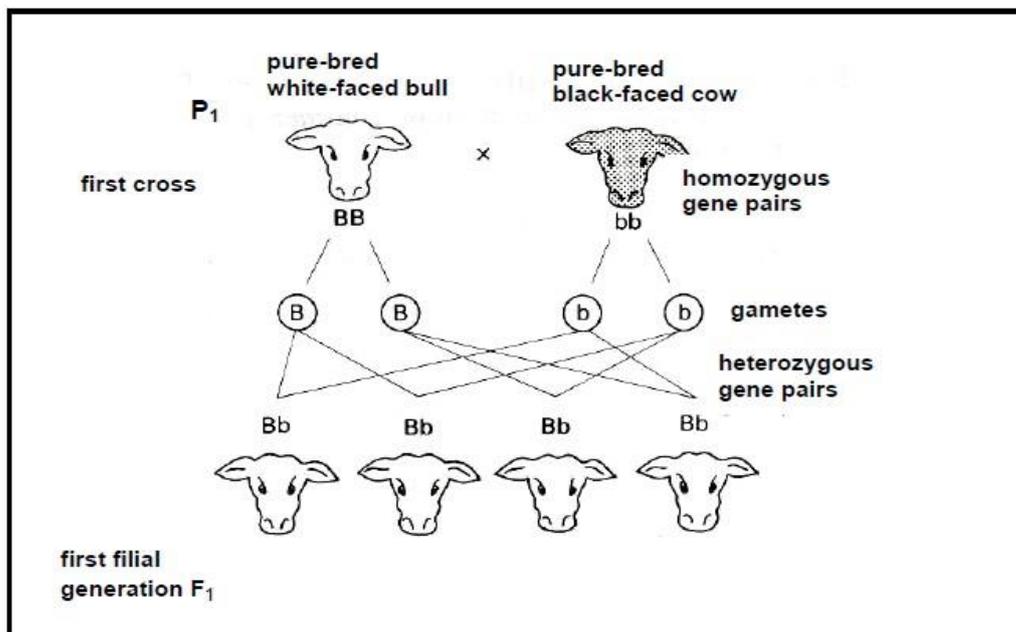
OR

Mix 26,6 parts of maize ✓ with 2,8 parts of sunflower oilcake meal ✓ (5)

Example 3:

Question (4.1, 2011, March– P2):

The schematic representation below represents the crossing between a purebred white-faced bull and a pure-bred black-faced cow.



- a) Explain the possible percentage of black-faced offspring if the same bull above in P₁ is used with its own daughters from the F₁-generation. (3)
- b) Compare the chromosome number of the somatic (normal) body cells with that of the gametes in the illustration above. (2)

Discussion:

This question is classified as moderately difficult because:

- Answering the question requires candidates to have a good understanding and application of genetics concepts in agriculture. Monohybrid is as a challenging topic in genetics to an envisaged Grade 12 candidate. The topic highlights a number of knowledge elements, for example genetic application and traits (**content**).
- The schematic representation provides clear direction to candidates. However, the genetic terminology used in the source material, namely 'homozygous' and 'heterozygous' may be challenging to the envisaged candidate (**stimulus**).
- In question a) candidates are expected to explain the percentage of black-faced offspring when parent is crossed with offspring. The candidates will be required to calculate the percentage of the F₂ generation. Question b) requires the candidates to compare the chromosome number of the somatic cells and gametes. There are no chromosome numbers given in the source material (**task**).
- Question a) allocates 2 marks for explanation of the crossing parent and offspring. A mark is allocated for providing a percentage. Question b) allocates 2 marks for a comparison of the somatic body cell and gametes based the number of chromosomes (**expected response**).

This question is moderate with regard to all four sources of difficulty.

Memorandum/Marking guidelines

a) Black faced offspring crossings

- Possible genotypes are BB or Bb and no bb. ✓
- bb represents the black faces. ✓
- No bb is equal to 0% black faces. ✓

(3)

b) Chromosome comparison

- Somatic cells have double/twice the number of chromosomes/2n/diploid ✓
- Gametes have half the number of chromosomes/n/haploid ✓

(2)

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

Example 1:

Question (2.3, 2010, November – P1):

During a digestibility trial with maize consumed by a pig, 49 kg of maize was consumed and 12 kg of manure was excreted. The results are indicated in the table below:

COMPONENTS MEASURED	DRY MATERIAL	CRUDE PROTEIN	CRUDE FIBRE	NITROGEN-FREE EXTRACT
Maize	40,33 kg	4,80 kg	0,94 kg	34,32 kg
Droppings	4,6 kg	0,86 kg	0,62 kg	2,11 kg
Amount digested	37,73 kg	3,94 kg	0,32 kg	32,21 kg
Digestibility coefficient	89%	82,08%	34,4%	93,85%

- a) Calculate the moisture content of the manure or droppings as a percentage. (Show ALL the calculations.) (4)
- b) The feed that was investigated in the above experiment was a concentrate. Give TWO reasons from the data in the table above to support this statement. (2)

Discussion:

Both parts a) and b) of this question are categorized as difficult for the envisaged Grade 12 candidate because:

- Digestibility co-efficiency is a challenging topic to the envisaged Grade 12 candidate. The candidates need to demonstrate a sound understanding of procedures and principles governing calculations of digestibility co-efficiency. Hence, this content topic is regarded as difficult to the envisaged Grade 12 candidate **(content)**.
- The table on the source material is overloaded with data which are not critical in the calculation of digestibility of the feed. Candidates are required to comprehend and interpret the data provided on table. The source material contains a number of specialized animal nutrition terms such as 'nitrogen free extract', and 'crude protein' which require a high conceptual demand **(stimulus)**.
- Question a) requires candidates to calculate moisture content in the animal dropping. The candidates will have to identify and use correct data from the table in order for them to calculate. Candidates will have to show a step by step calculation of the task. Question b) requires candidates to interpret and analyse data from the table in order to provide reasons. The reason to justify that the feed is a concentrate should be highly supported by the data provided on the table **(task)**.
- Four marks are allocated for question a) for candidate, showing the calculation on step by step as to arrive at the correct answer. Two marks are allocated for question b). Candidates are expected to provide two reasons linked to the digestibility trial data results provided on the table.
- Marking of this question will be challenging to markers when candidates present different methods of calculating the digestibility co-efficiency **(expected response)**.

This question is difficult with regard to all four sources of difficulty.

Memorandum/Marking guidelines

a) Calculate the moisture content of the manure

$$12 \text{ kg} - 4,6 \text{ kg} = 7,4 \text{ kg} \checkmark$$

$$4.6 / 12 \times 100 \checkmark$$

$$7,4 \text{ kg} / 12 \text{ kg} \times 100 / 1 \checkmark$$

OR $38,3\% \text{ DM} \checkmark$

$$= 61,7\% \checkmark \checkmark$$

$$100\% - 38,3\% = 61,7\% \checkmark \checkmark$$

(4)

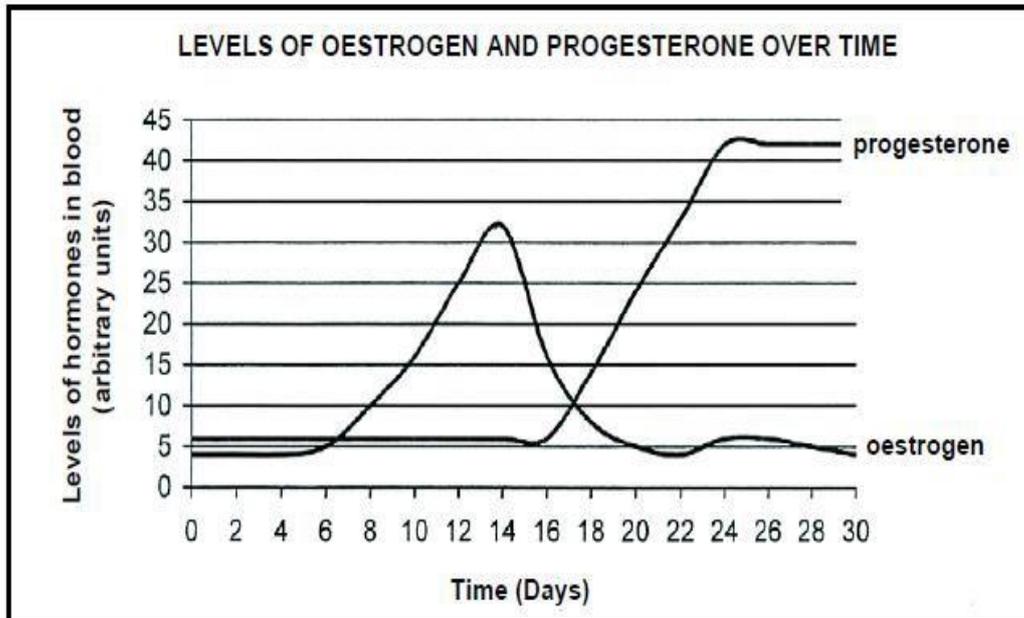
b) Type of concentrate feed used

- The feed was maize which is an example of a concentrate. ✓ =
- Very high digestible coefficient values/High TDN value. ✓
- Low in crude fibre/Crude fibre of 0,94 kg. ✓
- High in carbohydrates/Nitrogen-free extract/High in energy. ✓ (Any 2) (2)

Example 2:

Question (4.2, 2012, November – P1):

The graph below shows the levels of two hormones, namely oestrogen and progesterone in a cow that became pregnant.



a) Give evidence from the graph that suggests that an ovum was fertilised. (2)

Discussion:

This question is classified as a difficult question because:

- Candidates need to have a good understanding of how female hormones especially oestrogen and progesterone control the animal behaviour. The content on female hormones and pregnancy is conceptually challenging to an envisaged Grade 12 candidate (**content**).
- The graph is clearly presented and is not overloaded with information. Graph reading and interpretation are a challenge for the envisaged Grade 12 candidate. The comparison between two hormones, progesterone and oestrogen will present a challenge to candidates (**stimulus**).
- The question requires high reading, interpretation and analysis demand on the envisaged Grade 12 candidate. The candidate will have to spend more time reading, interpreting and analysing the graph in order to have a clear understanding of how the female hormones keep changing on daily basis (**task**).
- Two marks are allocated for identifying the period when the ovum is fertilized from the graph which makes the task easier to mark (**expected response**).

This question is difficult with regard to content, stimulus and task sources of difficulty.

Memorandum/Marking guidelines

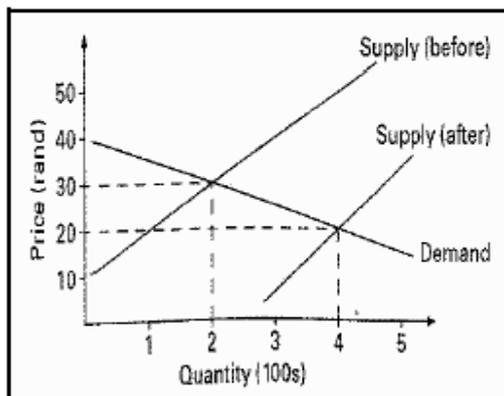
Progesterone

- Sharp increase in the level of progesterone from the 15th day. ✓
 - Sharp decrease in levels of oestrogen from the 13th day. ✓
- (2)

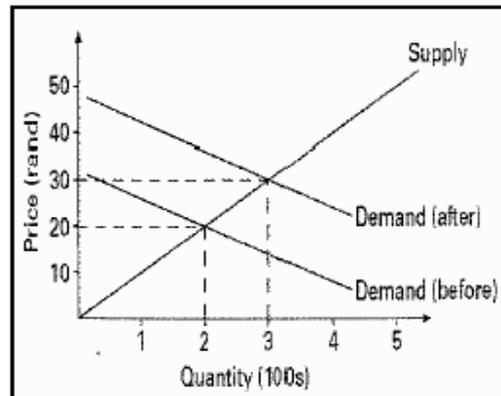
Example 3:

Question (2.4, 2011, Nov –P2):

The graphs below show the changes in equilibrium prices when the supply (GRAPH A) and demand (GRAPH B) of a product increase or decrease at different times.



GRAPH A



GRAPH B

- Deduce the relationship between supply and demand as illustrated in the graphs above. (2)
- Describe the effect of supply at different times on the equilibrium price, as illustrated in GRAPH A above. (2)
- Determine the quantities of the product sold at the equilibrium price before and after a specific event that affected the marketing of that product, as indicated in GRAPH B. (2)

Discussion:

This question is classified as difficult because:

- Candidates require a good understanding of the marketing concepts and principles as applied in various farming businesses. The questions assess a number of knowledge elements, for example 'relationship between supply and demand'; 'equilibrium prices' which poses conceptual challenges to the envisaged candidate (**content**).
- The two detailed graphs in the source material present a challenge to the envisaged Grade 12 candidate. The graphs are almost similar but yet they are different. This is another challenge to candidates (**stimulus**).
- Candidates are required in Question a) to deduce the relationship between supply and demand. Candidates will have to interpret and analyse data provided in the graph to respond to the question. In Question b) candidates are expected to describe the effect of supply at different times by interpreting and analysing two supply curves.

In question c) candidates are required to determine the quantities of the products sold by interpreting and analysing the two demand curves. The three questions are challenging to the envisaged Grade 12 candidate due to the nature of interpreting and analysing of two graphs on supply, demand and price equilibrium **(task)**.

- Question a) is allocated 2 marks on deducing the relationship between supply and demand. Question b) is allocated 2 marks allocated for describing the equilibrium price changes over a given time. Lastly, question c) is allocated 2 marks to determine the equilibrium stages on the graph. The expected responses from the three questions are complex in nature hence are challenging to the envisaged Grade 12 candidate **(expected response)**.

This question is difficult with regard to all four sources of difficulty.

Memorandum/Marking guidelines

a) Relationship between supply and demand

- As the quantities supplied increase. ✓
- the demand for the product will decrease. ✓
- As the quantities demanded increases. ✓
- the supply of agricultural product would decrease. ✓ (Any 2) (2)

b) Effect of supply at different times on the equilibrium price

- Equilibrium price high at supply (before) and low at supply (after)/the supply described as before had an equilibrium price that was higher. ✓
- Compared to the situation after. ✓ (2)

c) Quantities of the product sold at the equilibrium price

- Quantities before: 200. ✓
- Quantities after: 300. ✓ (2)

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

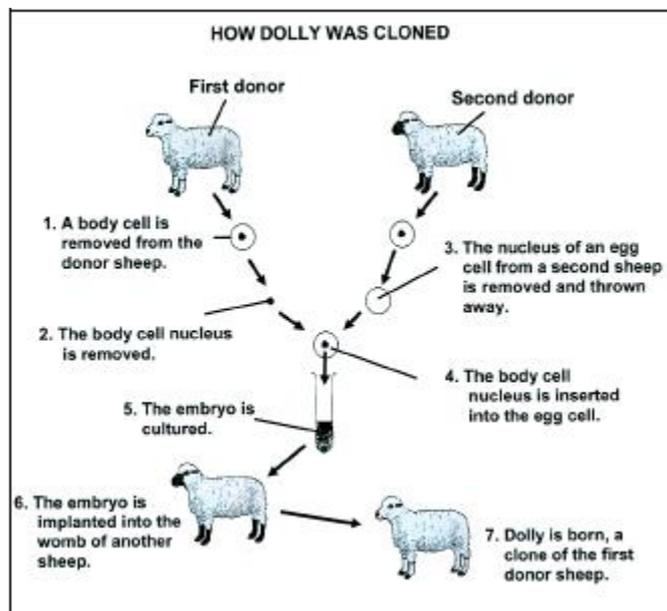
Note:

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 (4.4, 2012, November – P2):

The diagram below shows the cloning of a sheep named Dolly



- Describe briefly the reasons for removal of the nucleus from the egg cell of the second donor before the sheep could be cloned. (2)
- The step marked 5 in the diagram above states that 'the embryo is cultured'. Discuss the process of cell division through which the embryo develops. (2)
- Explain why it is impossible for Dolly to have any characteristics of the second donor sheep. (2)

Discussion:

All the set question on parts a), b) and c) are classified as very difficult questions because:

- To answer the question candidates need to know and understand the cloning concept which is very challenging to the envisaged candidate. Cloning is new content in CAPS which also poses challenges to subject teachers to explain in simple way to candidates. Basically, for candidates to understand and comprehend cloning they will need to be strongly grounded on genetic principles as a foundation for the concept. The concept is abstract to most candidates because it cannot be performed or demonstrated under normal circumstances. This cloning concept is conceptually very challenging for the envisaged Grade 12 candidate (**content**).
- The source material is overloaded with information thus making high reading demands on the envisaged Grade 12 candidate when attempting to conceptualize the illustration. There is certain topic-specific phraseology such as 'donors' and 'embryo culturing' that pose serious challenge to the envisaged Grade 12 candidate (**stimulus**).

- To all these questions candidates will have to apply their acquired knowledge on animal cloning and use inferential comprehension. The envisaged Grade 12 candidate would find reading and interpreting the data time consuming. The task in Question a) entails providing reasons for the removal of a specific cell from the donor which is a challenging aspect for the envisaged Grade 12 candidate. Question b) entails discussing thoroughly the embryo culturing which is a very difficult process to unpack for the envisaged Grade 12 candidate. In Question c) candidate is expected to fully explain why the characteristics of the second donor are not visible on the offspring when two cells were infused which makes it very difficult to comprehend **(task)**.
- Question a) has 2 marks allocated on the reasons the candidate will have provided on why the nucleus is removed from the cell. Question b) 2 marks are allocated for discussing the process of embryo culture as it unfolds in the test tube. It is very difficult for candidates to give a full description of embryo culturing. Question c) 2 marks are awarded for explaining why it is impossible for donor characteristics to be visible on the progeny. All the three questions are very challenging because of the difficulty that candidates confront when they try to formulate answers. **(expected response)**.

This question is very difficult with regard to all four sources of difficulty.

Memorandum/Marking guidelines

a) Reason for removal of 2nd nucleus

- Only the egg cell is needed without the nucleus ✓ and
- no chromosomes (DNA) needed ✓ **OR**
- The donor nucleus will be inserted ✓ and
- only one nucleus can exist in the cell ✓ (2)

b) Process of cell division

- Mitosis ✓:
The process in cell division by which the nucleus divides, typically consisting of four stages, prophase, metaphase, anaphase, and telophase, and normally resulting in two new nuclei, each of which contains a complete copy of the parental chromosomes. ✓ (2)

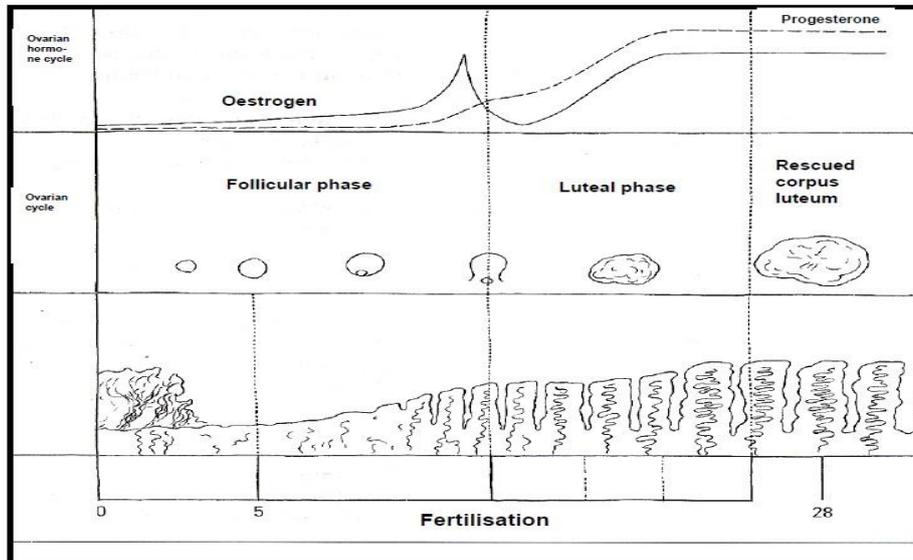
c) Reasons why Dolly does not have any other characteristics

- The nucleus with DNA/genes/chromosomes from the second donor sheep ✓ has been removed, ✓ (2)

Example 2:

Question (4.1, 2012, March – P1):

The diagram below illustrates hormone release during the oestrus cycle.



Discuss changes that the follicle undergoes during the oestrus cycle by referring to the diagram above. (4)

Discussion:

This question is classified as a very difficult question because:

- To answer the question, candidates need to know the hormonal effects in the reproductive cycle of the cow which is a very challenging topic to comprehend. The question includes concepts such as 'follicular phase', 'luteal phase' and 'rescued Corpus Luteum' which are very difficult for the envisaged Grade 12 candidate (**content**).
- The source material requires high reading, interpretation and analysis on the part of the envisaged Grade 12 candidate. The graph is loaded with data which have no direct consequence to the question. Hence, the source material is very difficult for the envisaged Grade 12 candidate to interpret (**stimulus**).
- The question requires candidates to discuss the changes that the follicle undergoes during the oestrus cycle. But the explanation should be based on the data provided on the illustration. The discussion will include the use of correct data from the illustration and it will involve interpretation and comprehension of fairly complex data provided. The question is very difficult for the envisaged Grade 12 candidate to unpack (**task**).
- Four (4) marks are allocated for question for discussing the process on how the follicle undergoes changes through hormonal influences from the time the follicles start to develop in the ovaries until it ruptures to release the matured follicle. Furthermore, the candidate explanation should be grounded on the data provided on the illustration. Marking will be complicated in that the question did not require answer in sequence (**expected response**).

This question is very difficult with regard to all four sources of difficulty

Memorandum/Marking guidelines

THREE changes that take place with the follicle during the oestrus

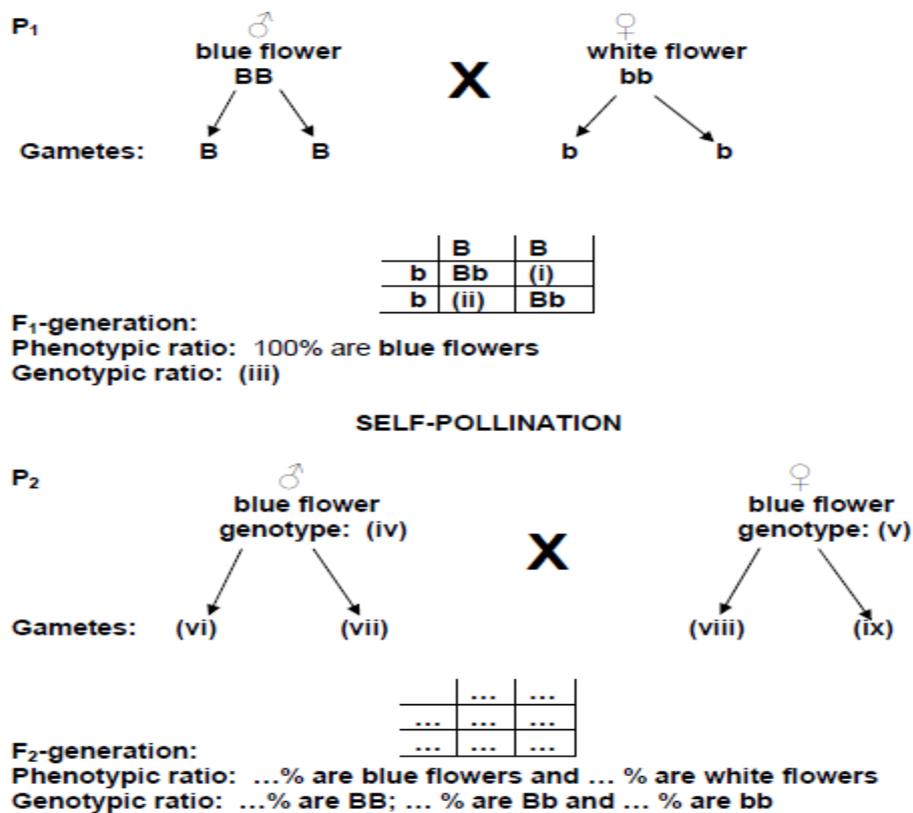
- Follicle becomes bigger/grows/enlarged. ✓
- Ovum develops in the follicle. ✓
- Ovulation takes place/ovum is released. ✓
- Corpus Luteum develops. ✓

(4)

Example 3:

Question (4.2, 2011, March P2):

The blue lily (*Agapanthus africanus*) is an annual and ornamental plant that has two species that bear either blue (B) or white (b) flowers. The following schematic representation shows the crossing from P₁ to F₂:



Determine the genotypic ratio as a percentage of each genotype in the F₁-generation and F₂-generation above.

Discussion:

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

- Answering the question requires candidates to have a good understanding and application of genetics concepts in agriculture. Monohybrid in plant breeding is as a challenging topic in genetics to the envisaged Grade 12 candidate. The topic highlights a number of knowledge elements, for example phenotypic and genotypic ratios determination. Genetics is generally regarded as a challenging topic and very difficult for

an envisaged Grade 12 candidates (**content**).

- The illustration given is overloaded with data which the candidates will have to read and interpret in order to understand the whole crossing from F₁ to F₂ generations. Some of the subject specific terminology used in the source material, namely 'gametes' and 'phenotypic and genotypic ratios' are challenging to the envisaged Grade 12 candidate. However, the crossing graphics and Punnet squares used provide a guidance but still require more time to conceptualize the data provided (**stimulus**).
- The question requires the candidates to determine the genotypic ratio from F₁ generation to end with F₂ generation which requires lot of time and various steps (multi-steps) will have to be followed to arrive at the final answers. Firstly, candidates are expected to find answers for the Roman Figure (i) and (ii) in order to find the appropriate answer for the genotypic ration required in roman Figure (iii). Furthermore, candidates are not given credit or marks for the task done in (i) and (ii) but demanded from them to find answer for such activities in order to get the genotypic ratio in F₁ generation. Lastly, candidates are again expected to find the correct answers for Roman figure (iv); (v); (vi); (vii); (viii) and (ix) and no marks are allocated (awarded) for such tedious activities, in order for the candidate to arrive at the remaining THREE genotypic ratios needed. Hence, the task is very difficult based on the procedures and principles which have to be followed in answering the question (**task**).
- Question have four (4) marks allocated specifically for firstly determining the genotypic ratio for the F₁ which is one (1) mark and secondly the three F₂ generation genotypic ratios which is three (3) marks). In relation to expected response from candidates the question is complex hence the response will be challenging to the envisaged Grade 12 candidate (**expected response**).

This question is very difficult with regard to all four sources of difficulty

Memorandum/Marking guidelines

Genotypic ratio F₁

- 100% is Bb ✓ (1)

Genotypic ratio F₂

- 25% BB ✓
- 50% Bb ✓
- 25% bb ✓ (3)

9. Concluding remarks

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