

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

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2019 NSC CHIEF MARKER'S REPORT

SUBJECT:	LIFE SCIENCES
PAPER:	2
DURATION OF PAPER:	2 HOURS 30 MIN
DATES OF MARKING:	30 NOVEMBER -13 DECEMBER 2019

SECTION 1: (General overview of Learner Performance in the question paper as a whole)

General performance

The general performance of the learners was evaluated from a sample of 100 scripts from the 12 districts in the province. Only one script was sampled per centre to allow sampling over a wide range of centres. The range of the sampled scripts was distributed as follows:

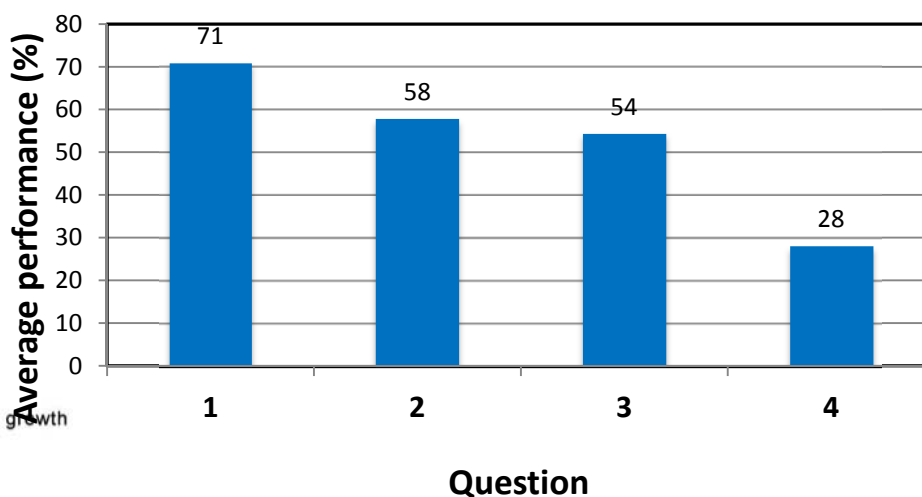
24 scripts – Level 1 to Level 2 (0-59 marks)

44 scripts – Level 3- Level 5 (60-104 marks)

32 scripts – Level 6 to Level 7 (105-150 marks)

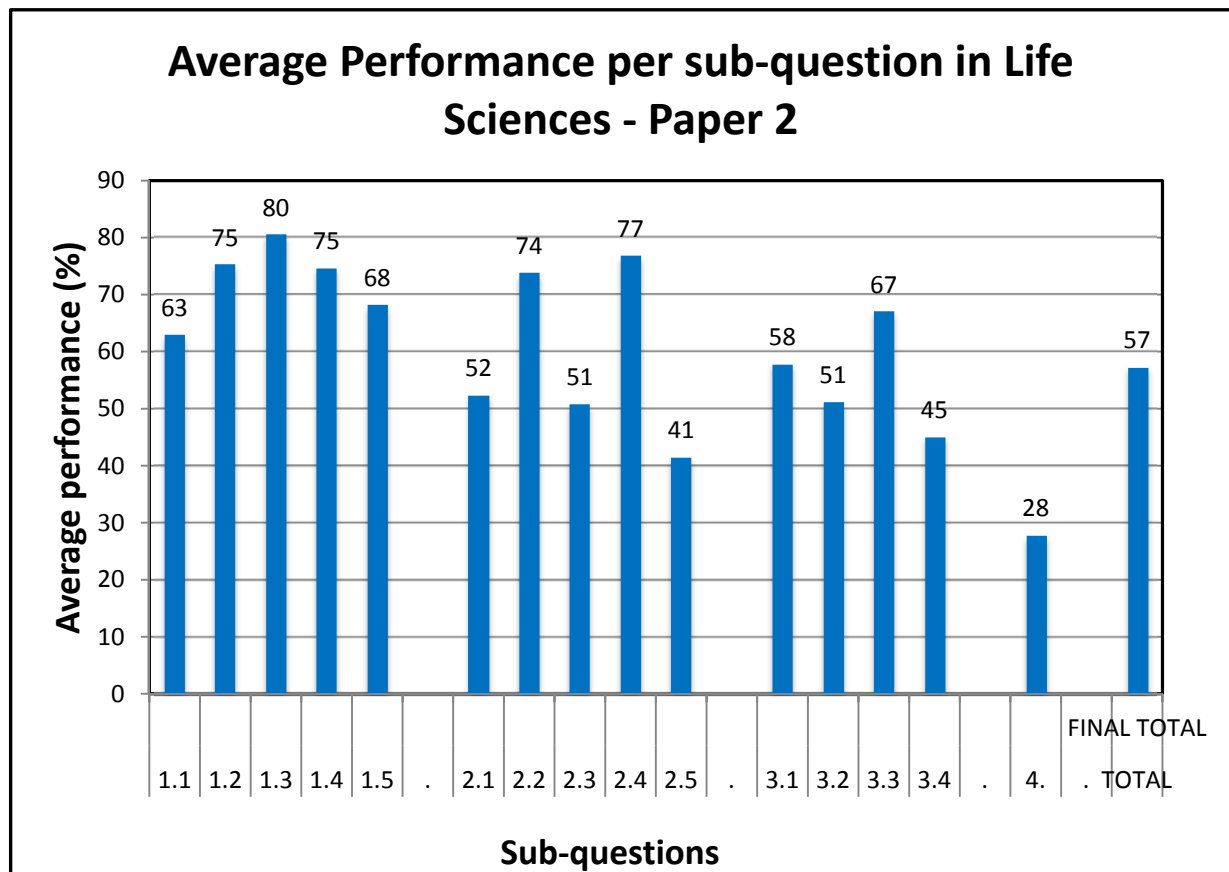
The graph below depicts the performance of the learners per question and sub-question:

**Average Performance per question
in Life Sciences - Paper 2**



Ikamva eliqaqambileyo!

The performance of the learners in the question paper as the whole is almost consistent with last year's performance with just a 1% decrease in the average of the paper. The performance of learners was better in questions 1, 2 and 3 compared to last year, with learners attaining averages above 50% in these questions. In question 4 the learners performed poorly with an average of 28% which is 21% lower than the performance in question 4 last year.



Based on the graph above, the most poorly answered questions (i.e. below 50%) are:

- Question 2.5 (41%) – a scientific investigation question based on evolution in present times incorporating application of evolution by natural selection
- Question 3.4 (45%) - an extract based on evolution with reference to sources of variation and an application of Lamarckism.

Question 4 (28%) – based on Genetics incorporating sex determination, role of blood grouping and DNA profiling in determining paternity.

SECTION 2:

Comment on candidates' performance in individual questions

(It is expected that a comment will be provided for each question on a separate sheet).

QUESTION 1

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The question contributed to most of the total marks scored by the learners. The question was answered reasonably well, with learners attaining an average of 71% in this question, a 3% improvement from last year's performance. There was also a marked improvement of 15% in Question 1.2 on terminology from 60% in 2018 to 75% this year.

A breakdown of learner performance in various sub-questions is as follows:

Average mark from the sample of 100 scripts :		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
1.1	MCQ	63
1.2	TERMINOLOGY	75
1.3	AB MATCHING	80
1.4	MEIOSIS	75
1.5	DIHYBRID CROSS	68

1.1.5 Most learners were unable to interpret the pedigree diagram correctly. Learners displayed confusion pertaining to terms such as recessive allele, dominant allele, homozygous, heterozygous. Learners are still struggling with analysis type of questions (1.1.5; 1.1.7). The options given in these questions were not clear-cut. They required the learners to apply what they have been taught at school.

1.2 Although the sampling shows an improvement in the terminology question compared to last year, there are still some learners who are performing poorly in this question with some learners getting zero in the whole question.

1.2.7 Some learners gave the answer as Australopithecine instead of genus *Australopithecus*. This was not credited as Australopithecines are the hominids of the genera *Australopithecus* and *Paranthropus*. The question was specific as to the genera to which Little foot and Mrs Ples belong.

1.3 Most learners managed to answer this question correctly, however, in

question 1.3.1 some learners could not grasp the fact that DNA is also found in the mitochondria and not only in the nucleus.

1.4 Too many learners are still struggling with the topic of Meiosis. Many learners simply forget that this process is made up of two phases, Meiosis I and Meiosis II and as a result many of the learners lost marks unnecessarily in not stating whether a particular diagram was in phase I or phase II of Meiosis.

1.4.1 (b) where learners are not able to identify a chromosome. They wrote bivalent, chromosome pairs, chromosomes etc.

1.4.3 (c) Learners did not read the question properly and were easily side tracked by the inclusion of Down Syndrome in the question and merely gave the answer as that of a person with the condition although the question required the number of chromosomes in the somatic (body) cells of a normal mother.

1.5 Although the average performance in this question based on dihybrid crosses in genetics is 67% some learners struggled with determining the genotypes of the parents in question 1.5.3 (a).

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

- Learners lack application skills in answering questions
- Lack of understanding
- Limited content knowledge
- Spelling mistakes e.g. uracine instead of uracil
- Using broader term for a specific term e.g. Australopithecines instead of *Australopithecus*

Some learners cannot distinguish between monohybrid and dihybrid crosses and therefore do not understand that dihybrid crosses involve two different genes.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Emphasis should be made before the start of a chapter on the terminology related to that specific chapter. Learners should compile lists of terms pertaining to the topic.
- Worksheets should be given to learners where they are asked to write definition of terms or give terms for given descriptions.
- English Across the Curriculum should be incorporated in teaching terminology e.g. breaking down terms into prefixes and suffixes for better understanding of the origin of the term and its meaning

- Teachers should place more emphasis on spelling and pronunciation of different words (terms). Many words used in Life Sciences can change to mean something else in Life Sciences if incorrectly spelt e.g. locus vs locust; ribose vs ribosome, Australopithecine vs *Australopithecus*
- Learners should have the skill of following instructions when answering questions
- More emphasis should be placed on the correct labelling of the nuclear membrane and cell membrane pertaining to cell division.
- Learners should be trained to only answer what is required of the.
- Learners must be taught to distinguish between a chromatid and chromosome.
- Learners should be given an opportunity to read out loud the questions themselves and analyze what is required of the question.
- Teachers and learners can download the JSDT Solution for Life Sciences APP from Playstore available for Grade 12 and 11 where they can revise questions for section A.
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(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

English remains a learning barrier to many learners that have it as a second language. It is either the learners do not understand the question or they do not know how to express themselves in English, although they might know the answer. Word quiz activities must be organized at the schools so that learning terminology is fun for the learners. Subject Advisors must conduct workshops for the implementation of English Across the Curriculum, if not already done. If workshop has been done, monitoring of implementation of EAC must be part of Subject Advisors onsite visit to the schools. ICT integration can also be incorporated to lessons where teachers can design games which test multiple choice questions where learners can go in teams to quickly answer the question and score points. Teachers can visit kahoot.it to create the games.

QUESTION 2

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

Very few learners performed well in this question. The average for the whole question was 57% which is better than the performance in Question 2 last year. The range of marks from the sample of 100 scripts was from 3 to 38 out of 40. The average performance per sub-question is tabled below:

AVERAGE MARK FROM THE SAMPLE OF 100 SCRIPTS		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
2.1	Protein Synthesis	51
2.2	Transcription	73
2.3	Genetics- Types of Dominance focusing on the concept of recessive allele	50
2.4	Genetics – Dominance and Monohybrid cross	76
2.5	Scientific investigation on Evolution in Present times and Natural Selection	41

2.1.2 Most of the learners struggled with Question 2.1.2 (a) and (b) where they had to identify the anticodons and DNA base triplets for the next amino acid based on the diagram.

2.2 This question which was a description of translation was very well answered by the majority of learners attaining an average of 73%. Very few learners did not get full marks.

2.3 This question which was based on interpretation of genetic crosses given in a table format was very poorly answered and sampled learners managed to attain an average of 50%.

2.4.2 Learners could not explain why spotted is dominant

2.4.3 This question was well answered by most learners with an average of 89,6% from the sample. This shows that learners have been taught very well at school on how to represent a monohybrid cross.

2.5 This was a scientific investigation question on evolution in the present times focusing on resistance of *E. coli* bacteria to antibiotics. The question was the most poorly answered sub-question in question 2, with learners attaining a 41% average.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

2.1

- 2.1.2 (a) and (b) Learners could not relate the sequence of amino acids to the codons on the mRNA. They failed to identify the next codon that will be involved in the translation process, consequently, the wrong anticodon was provided. Also a few learners struggled with complementary base pairing.
- The diagram might have also contributed to the confusion because not all of the bases for the next codon were exposed, so the learners might have missed the first base of the codon obscured by the ribosome.
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- 2.1.2 (b) was directly linked to 2.1.2 (a) so if learners miss (a) they cannot get the correct answer for (b).

2.2 Very few learners confused transcription with DNA replication. Most learners referred to the involvement of two DNA strands as templates.

2.3

2.3.1 Learners confused co-dominance with incomplete dominance

2.3.3 Most learners gave an explanation based on the genotype to support black as recessive, instead of using information in the table to support their answer for identifying black as recessive. Some learners used cross 2 to support their answer which was not credited as the same black would be produced even when both parents were homozygous dominant for black, which doesn't prove beyond doubt that black is the recessive allele.

2.4

2.4.2 Again the learners explained using the genotype for spotted as heterozygous, thus both parents contributing an allele for a back without spots.

2.5

2.5.1 Most learners used the graph to identify the independent variable as time instead of using the aim of the investigation. Many learners wrote Antibiotic A and B as the independent variable. As this was a cognitive Level D question, learners were not credited for just quoting the independent variable from the aim without analysing the information and conclude that Antibiotic A and B are variations of the Type of Antibiotic.

2.5.2 Some learners simply copied what was written under the method/ procedure followed, instead of identifying other factors that should be kept constant which are not already mentioned in the question. Learners should note and differentiate between *factors that were kept constant* and *factors that should be kept constant*. Some provided answers for reliability instead of constant variables.

2.5.3 Learners did not understand the procedure followed in the investigation. They failed to take note that the data collected in the investigation was to do the process which was repeated over a period of six months, but the investigation was not repeated. However, the method did not specify the process that was repeated whether the pigs were once again injected or if it was the measuring process that was repeated. Hence the learners are referring to the repetition of the investigation.

2.5.5 Learners failed to understand that the investigation was based on the response of the bacteria to the antibiotic, as a result they referred to the average resistance of the antibiotic instead of resistance of the bacteria to the antibiotic. Some did not show the comparison although the data on the graph was comparative between two antibiotics.

2.5.6 Learners lost marks in the question on natural selection because they could not correctly describe the variation. Most referred to the variation in piglets and some to variation in the antibiotics. Very few learners did not focus on the resistance to Antibiotic A but referred to bacteria which are resistant to antibiotic A and others resistant to antibiotic B.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Co-planning between Grade 10, 11 and 12 teachers especially on topics that are linked e.g. passive immunity in Grade 10 under tissues, diversity of micro-organisms (bacteria, structure, characteristics and diseases in Grade 11 and evolution in the present times in Grade 12.
- Team teaching of the Scientific Method in Grades 10, 11 and 12.
- Learners should be given more opportunities to explain processes and check if they understand the differences between related processes e.g. DNA replication, transcription and translation using tabulations.
- Learners must also be shown animations using videos on processes to cater for those who understand visuals as opposed to memorizing descriptive text.
- For protein synthesis, learners must be exposed to questions based on interpretation of diagrams rather than memorising the process.
- More questions in table form must be given to learners as learners are poor in interpreting the table.
- Learners must be exposed to different scenarios on natural selection as they are taught on evolution and must also use the guideline provided on Mind The Gap Study Guide (pg. 71)
- Learners must be exposed to more scientific investigation questions and be drilled to read questions thoroughly

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

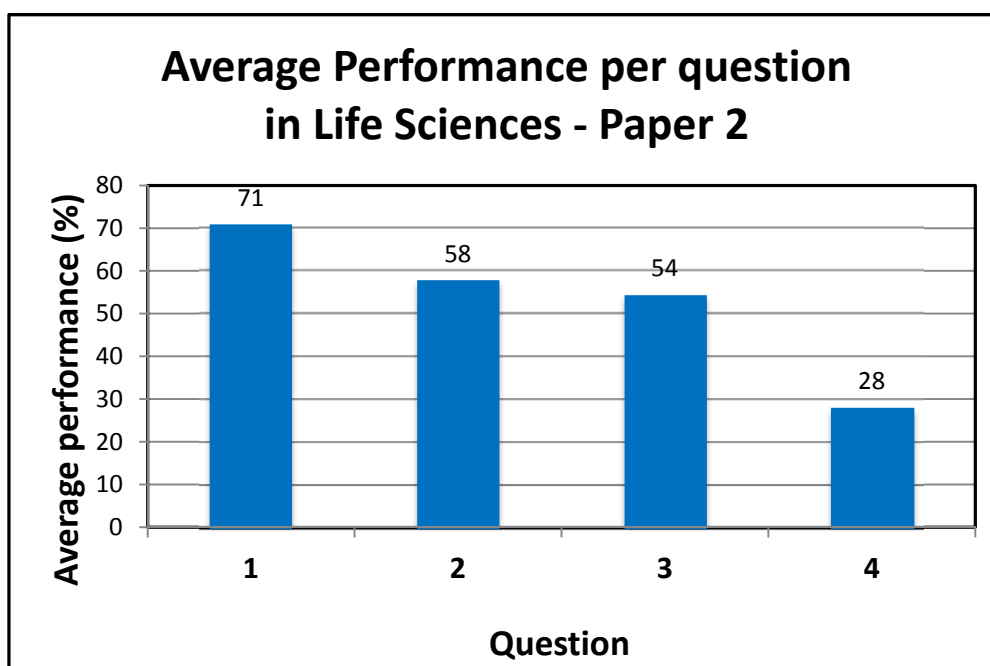
- Subject advisors must organize workshops on scientific investigations.
- Information sharing workshops to expose all teachers to areas of poor performance and learner misconceptions. Teachers must try to impart and capacitate learners on the skill on data interpretation through informal activities.
- Information sharing on how to approach certain topics must be done by the Subject teachers to make topics easier to teach
- Subject advisors must conduct in-service training for teachers to improve on data-based questions.

QUESTION 3

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The average for the whole question was 53%. The range of marks was from 1 to 38 out of 40 in this question.

The average performance per sub-question is shown in the graph below:



(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

3.1.1 Some learners failed to match differences in two columns, they struggled with the appropriate use of terms e.g. more or less protruding and prognathous; eye ridges instead of brow ridges; instead of using pronounced/less pronounced for brow ridges they used descriptive words that do not necessarily have the same meaning as pronounced e.g. large vs small or developed vs undeveloped or visible vs not visible. Some learners also talked about the brain size and position of the foramen magnum although these were not visible in the skulls. Some learners chose to name the skulls as human and apes and the information sometimes did not match with Skull 1 or 2 resulting in learners losing the marks.

3.1.2 Many learners wrote long upper limbs instead of long upper arm and thereby lost marks as they were referring to the whole arm instead of just the upper part of the arm. Some learners did not read the question carefully and ended up giving characteristics which were not specific to the upper limbs

e.g. eyes in front

3.1.3 Most learners got the mark for increased brain size but could not explain how this is related to intelligence. Instead learners gave a lot of examples such as communication, language, toolmaking.

3.2

3.2.1 Only 51% of the sampled learners gave the correct definition of bipedalism. Many referred to bipedalism as being able to walk on two limbs without specifying that hind limbs or lower limbs are the ones that are used in bipedalism. They lost marks because arms are also limbs and are not used for walking in bipedalism.

3.2.2 Most learners got the first part of the answer describing the evolutionary trends that occurred in the mentioned skeletal structures but failed to explain how the changes contributed to bipedalism. Most repeated the question by saying the changes occurred to support bipedalism.

3.3 Many learners showed confusion between species and population. Some referred to organisms being separated not population. A few also used geographical isolation instead of geographical barrier. This was a recall question which is laid out simply in the examination guidelines. The learners attained a 67% average in this question. learner's answers showed that they did not understand the process of speciation. many just wrote the key words they know about speciation without contextualizing the meaning of these words within what they wrote.

For example, they wrote such things as 'there was no gene flow *within* the separated populations' instead of writing 'there was no gene flow *between* the separated populations'; natural selection occurred independently without stating that it occurred between/ in each population. This resulted in learners losing up to four marks especially when they started with the species being separated by a geographical barrier and no mention of two sub-populations being formed and everything that follows after the separation occurs in these populations.

3.4

3.4.1 Some learners listed mutations as the source of variation even though the question asked for other sources of variation other the one mentioned in the question which was (gene) mutation. This clearly shows that some learners do not take time to read the question, they rush to give the answer without sifting the information as required by the question. Some learners listed the sources of variation which arise during the process of meiosis i.e. crossing over and random arrangement of chromosomes. In addition to these the learners would also give meiosis as the source of variation although the crossing over and random arrangement caters for meiosis as the source of variation. It was

surprising to see some learners listing random assortment of chromosomes as a source of variation although this was clarified in the Diagnostic Report of 2017.

3.4.2 (b) A number of learners included the mutant gene in their answer quoting the last sentence in the extract. Although there was a mention of altitude in the sentence, learners lost marks as they could not arrange their answer to include only the environmental factor.

3.4.3 Learners could not differentiate between high and low altitude and their influence on oxygen levels. Many rewrote the sentence from the extract linking red blood cells to altitude. For example, they said more red blood cells helped Tibetans to cope with high altitude and failed to link red blood cells with haemoglobin and oxygen levels which is linked to Grade 10 and 11 syllabi i.e. Transport systems in Animals and Transport of Gases respectively.

3.4.4 This was the most poorly answered sub-question in question 3.4 with learners only attaining a 27.2% average. Some learners describe Lamarck's two laws while some described what happened between Tibetans that lived at high altitudes and those that lived at low altitudes. There were those learners that wrote about the Tibetan and population and Han population. This clearly showed lack of application skills, more so in applying Lamarckism to a given scenario. Most learners wrote about the inheritance of the mutant gene as an acquired characteristic. The inheritance of the mutant gene is not in line with Lamarckism but rather in line with Darwinism, hence learners were not credited for this answer.

QUESTION 4

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

This question was attempted by the majority of the learners but it was the most poorly performed question in the whole paper especially on the section on the role of blood groups and DNA profiling in paternity testing. The average performance of learners in this question was 28%.

The three topics covered in the question were very clear and learners distinguished between them easily and therefore most scored the mark for logic.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Sex determination

In the examination guidelines on page 9 sex determination starts off by describing autosomes and gonosomes. Most learners gave too much detail on the karyotype and autosomes instead of focusing on the gonosomes.

Consequently, learners lost marks for relevance. Some learners mentioned amniocentesis as the procedure for sex determination and use of ultrasound scan for identifying the gender of the child. Most learners described the sperm as having 22 + XY chromosomes and the ovum having 22 + XX chromosomes which is an incorrect representation of the chromosomal composition of the gametes, as the gonosomes are described as being diploid instead of being haploid. Quite a number of learners stated that the X chromosome of the male fertilizes or fuses with the X chromosome of the female resulting in a female child or when the Y chromosome of the male fertilizes or fuses with the X chromosome it results in a male child. The learner descriptions were quite general and did not use correct scientific concepts e.g. many said the male gives Y and female gives X and a boy child results. They failed to mention that it is the gametes carrying the gonosomes that fuse together.

Role of blood groups in paternity testing

Most of the learners gave examples of inheritance of blood groups involving the blood group of the mother and suspected fathers. Some learners went into detail about the gene for blood groups having three alleles and four blood groups. Most learners showed various combinations of different blood groups and the possible blood groups of offspring without proving paternity e.g. If one parent is Blood Group A and the other is Blood Group B, the Possible blood groups of the offspring will be A, B, AB or O. This was showing inheritance of blood groups rather than proving paternity.

Some learners even used the different alleles to show their combination in the

genotype of the offspring, also not proving paternity. This resulted in learners losing the mark for relevance.

Role of DNA profiling in paternity testing

The examination guidelines as well as the CAPS approved textbooks do not supply enough detail on the interpretation of DNA profiles as they do for processes such as transcription, natural selection and speciation. Learners are taught to compare the bands of the child's DNA profile to both the mother and the father's DNA profile. The marking guideline specified that the bands of the child's DNA profile must first be compared to the mother's DNA profile and the remaining bands then have to be compared to those of the father's DNA profile. Many learners lost marks and were disadvantaged as they only made reference to the fathers' DNA profile matching the child's DNA profile without referring to the mother's DNA profile.

(c) Provide suggestions for improvement in relation to Teaching and Learning

Diagnostic reports to be discussed in a form of a workshop to teachers and that must be facilitated by subject advisors as teachers are not reading the reports.

Teachers who are not markers must be further assisted on challenges experienced by markers at the marking centre relating to candidates' performances.

Teachers are to be encouraged in the use of Examination Guidelines as part of their lesson preparation

A detailed description regarding the interpretation of DNA profiles for determining paternity or proving identity of a lost child must be provided to assist teachers in teaching this topic to their learners.

Teachers must refrain from using DNA fingerprinting but rather use DNA profiling as prescribed in the current examination guidelines.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Subject advisors must identify topics which are not in the CAPS prescribed textbooks but are mentioned in the examination guidelines and develop teacher support material including these identified topics. This must be mediated through mini workshops.
- Teachers need to help learners to describe genetic crosses in words.
- Teachers also need to develop their learners to have the ability to answer higher order questions and answer these questions with insight