Province of the EASTERN CAPE EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
Home of Examinations and Assessment, Zone 6, Zwelitsha, 5600
REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

2024 NSC CHIEF MARKER'S REPORT

SUBJECT	**LIFE SCIENCES**		
QUESTION PAPER	**2**		
DURATION OF QUESTION PAPER	**2½hours**		
PROVINCE	**EAST LONDON**		
NAME OF THE INTERNAL MODERATOR	**Ms Zimasa Sanda**		
NAME OF THE CHIEF MARKER	**Ms Phumzile Dlamini**		
DATES OF MARKING	**29/11/2024 – 12/12/2024**		
HEAD OF EXAMINATION:	**Mr E. M. Mabona**		

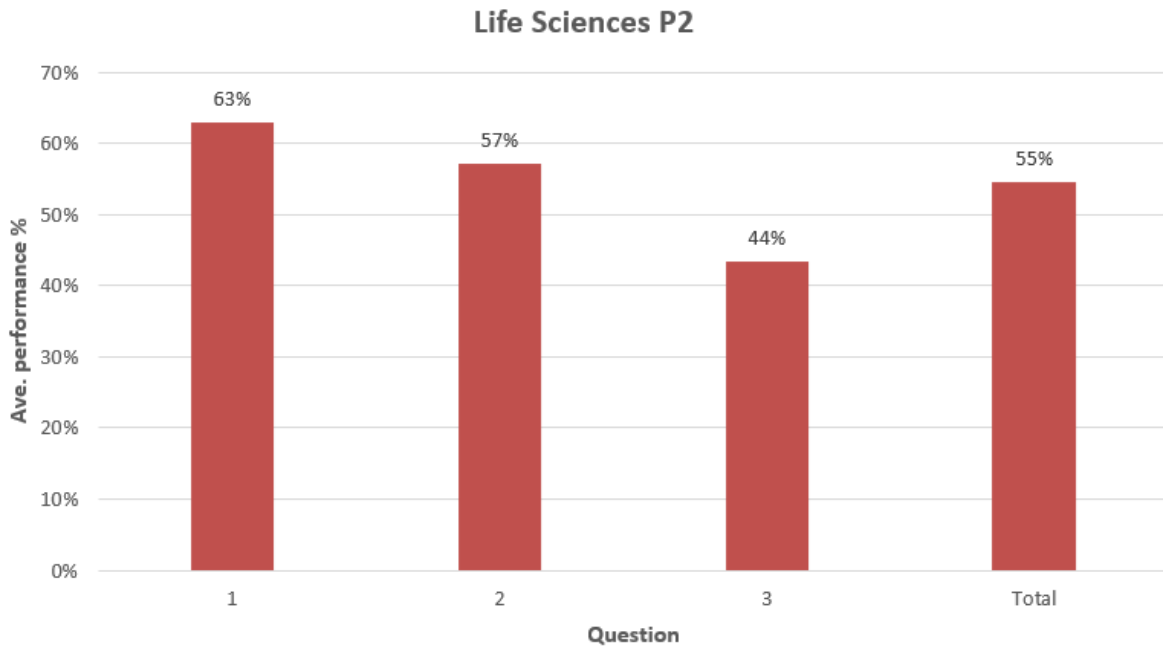
SECTION 1: (General overview of Learners Performance in the question paper as a whole)

The general performance of the candidate was evaluated from a sample of 100 scripts from the 12 districts in the province covering the low, mediocre and high performance. 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:

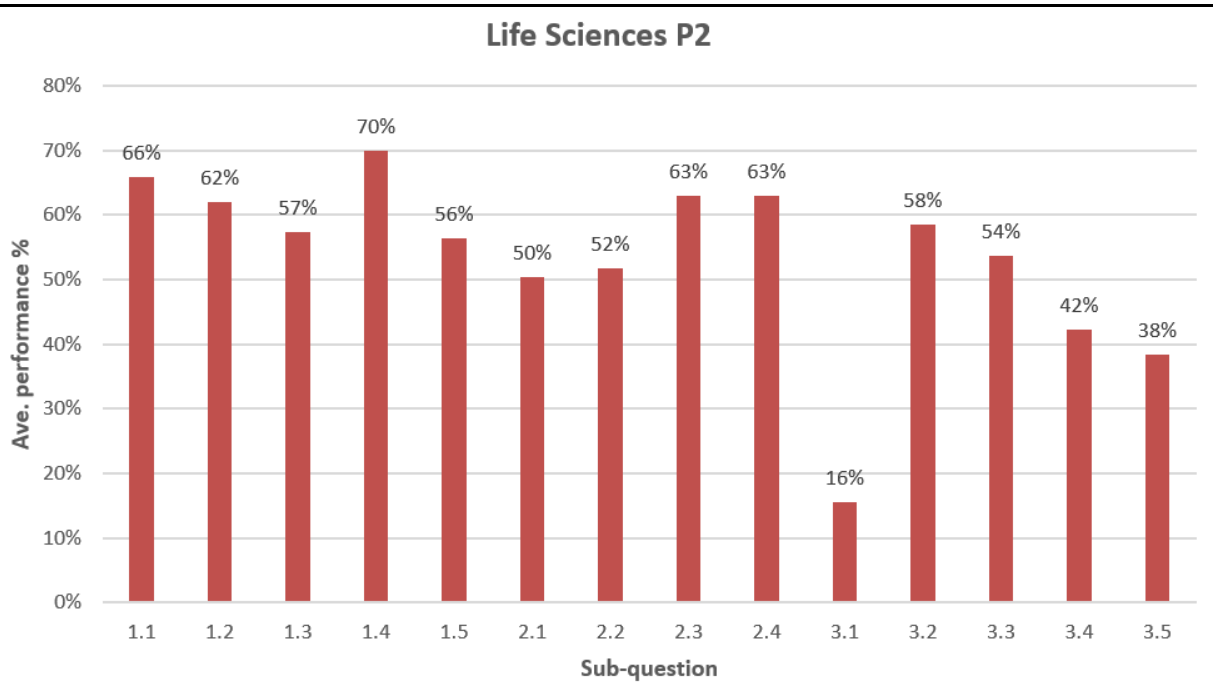
Low Performance (Level 1 - Level 2 i.e., 0-59 marks)	- 36 scripts
Mediocre Performance (Level 3- Level 5 i.e., 60-104 marks)	- 40 scripts
High performance (Level 6 to Level 7 i.e., 105-150 marks	- 24 scripts

The graph below depicts the average performance of the candidate per question and average performance in the paper as a whole:



The overall average performance of the sampled candidates shows a slight increase by 1% compared to 2023. The candidates performed best in Question 1 at 63%. However, the performance in this question has dropped by 3% when compared with 2023 performance. Candidates performed better in Question 2 compared to 2023 with an improvement of 6% Question 3 was the worst performed question at 44% which is 2% lower than the performance in 2024. Question 3 was mainly based on evolution (43 marks) and the remaining 7 marks was on genetic engineering. The topic of evolution counts 54 marks out of 150 marks in Paper 2 and it being taught in the third term. Probably teachers rush through the content and do not get sufficient time to revise this topic with the candidates.

The graph below depicts the candidate average performance per sub-question.



From the graph it can be seen that candidates performed best in Question 1.4 attaining an average of 70%. This question was based on a diagram representing DNA replication. The other questions in which the candidates performed fairly well were:

- Question 1.1. (66%) multiple choice questions from various topics
- Question 2.3 (63%) based on inheritance of blood groups and drawing of a bar graph
- Question 2.4 (63%) based on pedigree diagram involving sex linked inheritance
- Question 1.2 (62%) terminology questions from various topics

The most poorly answered questions with the candidates achieving below 50% were:

- Question 3.1 (29%) based on a passage on genetically modified maize. In 2023 the candidate achieved 22% in a similar question based on genetic engineering.
- Question 3.5 (38%) based on application of natural selection

Question 3.4 (42%) based on human evolution with the main focus being the Out-of-Africa Hypothesis, extracting differences between *H.erectus* and *H.sapiens* from the extract and making conclusions about bipedalism

QUESTION 1

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

The majority of candidates performed well in Question 1 with some candidate achieving full marks i.e. 50 marks.

QUESTION 1.1 Multiple Choice Questions – Average performance was 68%

Poorly answered questions:

- Question 1.1.5 with most candidate choosing A instead of D as the correct answer. Only 39% of the sampled candidate got this answer.
- Question 1.1.8 and 1.1.9 the average performance from the sampled candidates was 49%

QUESTION 1.2 Terminology – Average performance was 62%

Poorly answered questions:

- Question 1.2.2 only 42% of the sampled candidate could answer this question correctly. Some gave the answer as Aneuploidy or diploid instead of haploid.
- Question 1.2.4 Some candidates do not know what the t stands for in tRNA. Some wrote transport RNA/translate RNA
- Question 1.2.8 Many candidates left out I/1 when naming the phase and gave the answer as Metaphase instead of Metaphase I/1.

QUESTION 1.3 Match items and statements - Average performance was 57%

Poorly answered questions:

- Question 1.3.3 the average for this question was 24%. Many candidates chose B instead of Both A and B as the correct answer
- Question 1.3.2 66% of the candidate knew the answer. However, a few candidates seemed to be confused about the history of the discovery of the structure of DNA.

QUESTION 1.4 Structure of DNA and DNA replication – Average performance was 70%

Poorly answered question:

Question 1.4.2 (a) candidate did not give the collection term, instead they gave the individual components of a nucleotide

QUESTION 1.5 Dihybrid cross – Average performance was 56%.

Poorly performed questions:

1.5.3 (c) Average performance was 25%. Most candidates struggled to write the genotype of the gametes. Many wrote the answer *rree* instead of *re.*

1.5.3 (a) Although the average performance was 56% some candidates are incorrectly writing the notation of a genotype of an individual/organism by including a space between the letters representing the alleles of different characteristics.

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

- 1.1.5 Candidates could not differentiate between punctuated equilibrium and biological evolution resulting in the choice of A as the answer instead of D.

- 1.1.8 Candidates could not make a comparison between mitosis and meiosis. This is possibly because candidate do meiosis in Grade 12 and mitosis is done in Grade 10. However, in the exam guidelines (pg. 9) it is stipulated that candidate must be able to make a comparison between mitosis and meiosis with reference to the similarities and differences between the two types of cell division.

- 1.1.9 Candidates struggle with the history of discovery of fossils that serve as evidence for evolution. Many could not give a correct answer in 1.1.9 for the scientist who discovered the fossil Taung Child.

- 1.2.2 Candidates confused the term aneuploidy with haploid. The term aneuploidy refers to a condition in which an organism has one or more extra or missing chromosomes resulting in an abnormal number of chromosomes e.g.47 chromosomes instead of 46 chromosomes in humans. The term haploid refers to the chromosome condition of a cel that has a single set of chromosomes i.e. half the number of chromosomes for that species

- 1.3.2 Some candidates struggled with the history of the discovery of DNA. The examination guidelines (pg. 7) as well as the CAPS document lists the scientists involved in the discovery of DNA as Watson and Crick, Franklin and Wilkins.

- 1.3.3 Many candidates gave the answer as B only instead of Both A and B. It was evident that most candidate were not familiar with the term karyokinesis in cell division.

Candidates struggled to differentiate between:

- Meiosis I and Meiosis II
- Monohybrid and Dihybrid
- Types of bonds
- Centrosome, centriole and centromere
- Diploid and haploid
- Karyotype and karyokinesis
- Species and Speciation
- Genotype and Phenotype
- Genotype of individual and genotype of gametes

1.5.3 (a) RR ee – space between the letters representing the alleles of the different characteristics

1.5.3 (c) Many candidates incorrectly gave *rree* as the answer. This is the genotype of an individual with grey spots and brown eyes. The question asked for the genotype of the gametes produced by a butterfly with grey spots and brown eyes which should be *re*.

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

- Candidates must be made aware that they have to know the history of the discovery of fossils of the three genera described on page 17 of the 2021 Examination Guidelines in terms of: The age of each fossil, the fossil sites where they were found and the scientists who discovered them. Teachers must find easy ways for candidate to remember the scientists who discovered each fossil.

- When teaching the history of the discovery of DNA it is important to note that all 4 scientists were involved in the discovery of the structure of DNA.

    - James Watson and Francis Crick were credited for the discovery of the double-helix structure of DNA in 1953. Their model was based on X-ray diffraction images of DNA taken by Rosalind Franklin
    - Rosalind Franklin- her crystallography work provided crucial evidence for the double helix structure. Unfortunately, she was not awarded the Nobel Prize along with Watson and Crikc as she passed away before the prize was awarded
    - Maurice Wilkins worked with Franklin and shared the Nobel Prize with Watson and Crick.

- Teachers must note that cell division (mitosis & meiosis) includes both:
    - *karyokinesis* which refers to the process of nuclear division and
    - *cytokinesis* which refers to the division of the cytoplasm. These terms can be introduced in Grade 10 when teaching mitosis and again in Grade 12 when teaching meiosis.
- The term aneuploidy is NOT in the 2021 Examination Guidelines. Teachers should avoid using this term when they are teaching as it confuses the candidate, or they should indicate to candidate that it's only for enrichment and not for exam purposes. The examination guidelines state that candidate should be able to differentiate between haploid (n) and diploid (2n) in terms of chromosome number.
-
- When teaching dihybrid crosses teachers should emphasize the correct notation of writing genotypes of individuals and gametes. In scientific notation for genotypes, it is standard practise not to include spaces between the letters representing the alleles of different characteristics. So in 1.5.3 the genotype RRee or Rree should be written without spaces. Inserting spaces (e.g. RR ee or Rr ee) is unconventional and might cause confusion when communicating genetic information or analysing genetic crosses. It may be confused as the genotype of gametes. It is also important that candidate must keep letters representing alleles of the same characteristic together RRee and ReRe.

- Teachers must also emphasise to learners that in a dihybrid cross the genotype of a gamete comprises of two different letters representing the two different characteristics, hence in 1.5.3 (c) the genotype was *re* : r- grey spots, e- brown eyes.

The 2021 diagnostic report (pg. 164) can be consulted to train learners on which notations to use for each of the different types of inheritance.

(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 should draw up lists of similar sounding and confusing terminology, together with their descriptions and avail these to teachers and learners
- Teachers must highlight terminology related to each topic while teaching the topic.
- Learners must see and write the terms to improve their spelling and understanding. It is evident that many learners spell phonetically because they have only heard the terms.
- Cluster workshops to be organized for teachers. These enable teachers to be confident in the language of assessment.

- Revision activities and more exercises on dihybrid crosses must be given to candidate to complete on their own and not just see or copy from the board.

QUESTION 2 (Summary)

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

The average candidate performance in Question 2 has improved by 6% when compared with performance in 2023. Most candidate attempted all the sub-questions and performed above 50% in all the sub-questions. The best performed questions are 2.3 and 2.4 with candidates attaining 63% average in both questions. The highest mark achieved was 50 out of 50 and the lowest mark was 1 out of 50 marks.

Candidates performed fairly well in the following questions:
2.1.2 Description of transcription (55%)
2.2.1 Identification of the phase of meiosis (68%)
2.2.3 (a) Identification of a centriole (69%)
2.2.3 (b) Identification of a spindle fibre (91%)
2.3.1 Identifying the most common blood group from data give in a table (86%)
2.3.4 Drawing a bar graph (85%)
2.4.1 Determining the number of offspring from a pedigree diagram (80%)
2.4.2 (a) Giving the phenotype of an individual from a pedigree diagram (70%)
2.4.2 (b) Giving the genotype of an individual from a pedigree diagram (62%)
2.4.4 Genetic cross involving sex-linked inheritance (68,6)

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

The most poorly answered questions were:

2.1.4 Candidates struggled to give the correct sequence of bases. The average performance in this question was 6%. Most candidates read the diagram wrongly and did not see the template from where molecule Y is formed. Most candidate gave the complementary bases of Z from molecule Y i.e. ATG / AUG.

2.1.2 Candidates struggled to get all the 6 marks in this lower order, recall question and attained a 55% average. Most of them lost 2 marks by not mentioning DNA in the first bullet and writing DNA unwinds and unzips did not qualify for marks. Candidates had to write DNA double helix unwinds to get the mark for the first bullet. Some candidates are still confusing transcription with DNA replication and stating that each strand is used as a template.

2.1.5 Average performance was 48%. Candidates still struggle with the difference between a codon and an anticodon and struggle to deduce from a DNA to a mRNA to a tRNA. They don't understand that if a table is given, they must use the information in the table. For example, codon given for an amino acid, they could deduce that molecule Y is the mRNA with the codon they need.

Some candidates first changed the codons to anticodons as a result they gave the following answers:

First amino acid AGA → UCU → Serine

Last amino acid CCA → GGU →Glycine

Some wrote all three amino acids in the correct sequence when only the first and last amino acid were required e.g. arginine ✓→ tyrosine X → proline. The mark first two principle was applied so the candidate lost the mark for the third amino acid. They had to demonstrate the skill of selecting information and write only the required information.

2.2.2 Candidates struggled with stating one difference between Anaphase II as shown in the diagram and Anaphase I. The average performance in this question was 38%. Some candidates confused Anaphase with Metaphase, as a result they referred to homologous chromosomes/ chromosome pairs being pulled to the poles

2.2.4 Average performance was 46%. Very few candidates wrote that the spindle fibre attaches to the centromere. Most stated that spindle fibres just hold the chromosomes.

2.2.5. Candidates attained a 46% average in this question. Many were unable to draw a proper diagram for the phase required. Most also gave the labels they were instructed not use.

2.3.1 Well answered with an average performance of 86%.

2.3.2 Average performance was 48 %. Some gave incomplete and co-dominance as the answer.

2.3.3 Candidates attained a 34% average in this question. A number of candidates lost marks because they confused inheritance of blood groups with sex linked inheritance. They wrote that the child inherits blood group instead of the allele. Most candidates did a genetic cross and lost marks because they did not indicate the genotype of the child.

2.3.4 Well answered with an 85% average. However, some candidates lost marks for writing an incomplete caption, Y-axis label (left out units). For the scale on the Y-axis, they just wrote the numbers from the table without working out equal intervals between the numbers. A few candidates drew a histogram and forfeited 2 marks for type of graph and scale as the scale cannot be determined when the bars are touching.

2.4.1 Well answered with an 80% average. Some wrote 4 offspring including individual 6 who is not a child of individual 1 and 2.

2.4.2 (a) Mostly answered correctly (70% average) but some left out male. Some wrote the genotype X^DY and some wrote normal male or unaffected male.

2.4.2 (b) Some wrote X^DX^D some wrote X^Dx^b although it was clear that they could write d's and b's. Some wrote the phenotype i.e. female without muscular dystrophy

2.4.3 Some candidates struggled with this question. The average performance was 48%. Candidates lost marks for writing X/XX/XY without including chromosomes or gonosomes. Some just copied the sentence from the information given that says 'It is caused by a recessive allele on the X chromosome (X^d)'. A number of candidates referred to the X chromosome carrying the disease not the allele on the X chromosome. Some of them wrote in females the genetic condition is on one X chromosome and the other chromosome is recessive.

2.4.4 Average performance 68%. Most candidates got the marks, some lost marks on phenotype by using normal/unaffected/affected. A few candidates gave the wrong percentage 0/50/75/100.

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

- Learners confusing DNA replication, transcription and translation- teachers must use previous examination papers and ensure that learners practise answering questions based on these processes. The teacher must ensure that the learners must are able to differentiate between these processes. Low performing candidate can even be encouraged to memorise the processes.

- Teachers must always consult Chief Marker's and Diagnostic reports and apply all the necessary recommendations in their teaching. The 2021 Diagnostic Report (pg.163) highlights the similarities and differences between DNA replication and transcription. https://www.education.gov.za/Portals/0/Documents/Reports/2021NSCReports/2021%20Diagnostic%20Report%20Part%201%20Content%20Subjects.pdf?ver=2022-02-08-103527-000
- The November 2023 marking guideline has the description of DNA replication and this can be used as a guideline on how to describe the process of DNA replication.
- Learners must be given lots of practise questions on protein synthesis and must be trained to be able to extract information from tables with base triplets/codons/anticodon and amino acids given so that learners do not lose marks.
- Teachers must give learners as much work as possible on the diagrams of the phases of meiosis so candidate can easily differentiate between them.
- Learners must be taught to link structure and function of parts as many failed to correctly link the role of spindle fibres during cell division.
- The 2021 diagnostic report (pg. 163) also highlights how to explain inheritance of alleles in an individual/s as asked in Q 2.3.3

(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 can design an assignment on meiosis that includes drawing and observation skills as the learner lack these skills.
- Content gap workshops for teachers, addressing the challenging topics must be organized by Subject Advisors
- Mediation of Chief Markers and Diagnostic Reports by Subject Advisors is key in addressing the challenging topics and misconceptions by learners

QUESTION 3

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

The performance in Question 3 dropped by 2% from 46% in 2023 to 44% in 2024. This seems to be a trend when comparing 2022 results as well. The question mainly comprises of questions assessed from the evolution topic (43 marks) which is covered in Term 3 with limited time available before the preparatory examinations. The remaining 7 marks was set on genetic engineering (genetic modification).

Question 3.1 on genetic modification was the most poorly performed question with an average performance of 16%.

3.1.1 Average performance was 8%.

3.1.2 Average performance was 48%.

3.2.1 Well answered with an average of 80%

3.2.2 Poorly answered. The average performance in this question was 48%

3.2.3 Candidates struggled with this question and only attained a 27% average.

3.2.4 Wel answered, candidates attained a 78% average on this question.

3.2.5 Poorly answered with a 45% average.

3.3.1 (a) was not well answered. The average was 44%.

(b) The average was 56%.

3.3.2 Fairly answered with 58% average performance.

3.3.3 Was not well answered and the average performance was 47%.

3.3.4 Well answered with an average of 86%.

3.3.5 Very poorly answered with an average of 15%.

3.3.6 Very poorly answered with an average of 12%.

3.3.7 Fairly answered with 53% average.

3.4.1 Very poorly performed with an average of 23%.

3.4.2 Was not well answered and the average was 30%.

3.4.4 Average performance was 64% and was fairly answered.

3.5.1 The average performance on sampled candidates is 46%.

3.5.2 Well answered with a 77% average.

3.5.3 The average performance was 31%.

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

3.1.3 Candidates do not understand the process of genetic modification. In this case they had to consider:

- the source of the gene → Bt gene from bacterial DNA
- where is it transferred to → inserted into the maize DNA not just maize
- result → maize produces the Bt toxin

3.1.4 Candidates had to explain i.e. give statement and reason as to why farmers would want to grow Bt maize. Many candidates were giving benefits to the plant not the farmer. Most wrote the statement but gave a wrong reason for it.

3.2.2 Many candidates could not identify the correct species that is closely related to Old World

Monkeys. This probably due to a lack of the skill of interpreting a pedigree which they should have been exposed to already in Grade 11 when they do plant and animal diversity. Due to evolution being the last topic to be taught and it's a long topic, the teachers probably focus on teaching the content and do not expose the learners to sufficient activities which allow them to practise interpreting phylogenetic trees.

3.2.3 Many candidates cited that they share a common ancestor without indicating the letter representing the ancestor from the phylogenetic tree.

3.2.4 Some candidates were not able to interpret the phylogenetic tree and gave ' Orangutans' as an answer instead of humans.

3.2.5 Teachers and learners do not know the difference between upper limb (whole arm) and upper arm. Some learners gave similarities that had nothing to do with the upper limb e.g. eyes in front. A few learners gave the significance for bipedalism e.g. Hands to carry babies etc, Upright posture to identify predators, Eyes to spot and run away from predators.

3.3.1 (a) Many candidates lost a mark for writing the independent variable as 'influence' of the type of milk. This is implying the growth in height of the children which is the dependent variable.

(b) Candidates lost a mark for writing 'average height'

3.3.2 Some candidates missed a mark by writing discontinuous variation.

3.3.3 Candidates cannot differentiate between planning steps and the procedure. They merely copied the first bullet in the procedure.

3.3.4 A few candidates confused reliability and validity.

3.3.5 Many candidates wrote the controlled variables without linking it to the difficulty in maintaining the same conditions over 7 years.

3.3.6 Most candidates gave the sample size of 4146 indicating that a large sample was used. They did not mention that the sample 4146 children was divided into two equal groups of 2073 children. Most candidates lost a mark for this question.

3.3.7 Some candidates stated that cow's milk haa great influence /impact /more effective on height instead of explaining that children drinking cow milk grew taller than those who drank soya milk.

3.4.1 Candidates were unable to select information from all the information that they had been taught e.g. could not give information about Homo erectus extracted from the Out-of- Africa hypothesis which was clearly outlined in the 2021 Examination guidelines.

3.4.2 Candidates wrongly wrote oldest fossils of *Ardipithecus, Australopithecus* and *Homo habilis* were found in Africa only. They included *Homo erectus* in their answer even though the question stated OTHER fossil evidence which excludes *Homo erectus* as it was asked in 3.4.1. Some wrote the species names as well even though in the examination guidelines only genera are mentioned.

3.4.4 Some candidates did not follow the instructions of the question. They gave random differences. Most lost a mark for writing *Homo sapiens* have no brow ridges instead of reduced/less prominent brow ridges.

3.5.1 The definitions of a mutation, gene mutation and chromosomal mutation were highlighted in the 2020 Diagnostic Report (pg. 164). The performance in this question was disappointing.
https://www.education.gov.za/Portals/0/Documents/Reports/2021%20NSC%20Reports/Diagnostic%20Report%202020%20-%20Part%201.pdf?ver=2021-03-25-105406-000

3.5.3 High performing candidates answered very well. However, many candidates lacked the skill identifying the variation in the wolves and that it was linked to the presence or absence of the mutation which makes them immune to cancer. As a result, they could not correctly identify the favourable and unfavourable characteristic. They did not understand that immunity to cancer was due to a mutation not the exposure to high radiation. Some indicated the variation as having a trait of being exposed to high radiation and this trait of being exposed to high radiation was passed on. Others wrote that some wolves were resistant to high radiation and some not. Allele for resistance to radiation was passed on. Some candidates lost marks as they gave the general account of natural selection without applying it to the example of the wolves given in the question.

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

- Use many questions that require application regarding genetic engineering. Learners only know insulin production taught in Grade 11
- Use more visual aids, videos and charts
- Learners must be trained to pick out the relevant information in a question starting from Grade 10
- Train learners on how to answer application questions on genetic engineering and artificial selection as they tend to confuse these processes.
- More activities on phylogenetic tree diagram interpretation starting in Grade 10 when teaching History of Life and Grade 11 Plant and Animal diversity.
- Practise more investigative questions.
- Train learners to differentiate between reliability and validity. It is important to note that for this investigation measurement of average height was not accepted for reliability as measurement of the height was only done once at the end of the 7-year period.
- The aim of the investigation was of a comparative nature for the two treatments, hence for reliability the sample size for each group had to be specified not just the overall sample size.
- Include questions which require learners to come up with planning steps to be considered when an investigation is to be conducted as most learners confused planning steps with the procedure
- On Out-of- Africa hypothesis direct learners to pg. 17 of the Examination Guidelines. There is no other way of stating it. Learners must be taught how to apply the Out-of-Africa hypothesis by linking it to the fossils of a specific genus.
- Evolution must not be neglected even though it is the last chapter
- On application of natural selection learners must be trained to:
    - identify the variation pertaining to the given example
    - determine the selection pressure/changed environmental conditions
    - identify the favourable and unfavourable characteristic based on the variation
    - note that it is the allele coding for the favourable characteristic that is passed on
    - note that there will be a higher proportion of organisms with the identified favourable characteristic and NOT all the organisms will have the favourable characteristic
- Use past examination question papers to expose learners to various questions on natural selection both application questions and questions requiring learners to give a general account.

(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 should organize a How I Teach Evolution workshop where teachers can be assigned to present a section of the topic and share strategies on how to teach that section for learners to understand. - Subject Planner should organize teachers and subject advisors to unpack some of the challenging sub-topics in evolution through recording of short videos and WhatsApp voice notes which can be easily shared with learners - Make use of Mind the Gap study guide for the diagrams which show similarities and differences between African Apes and Humans - Use the DBE Self-Study guides to guide learners on how to answer questions and address challenges and misconceptions from previous year's examination questions.