AGRICULTURAL SCIENCE

6115
Paper 1

GENERAL COMMENTS

There was a slightly improvement in standard and manner in which candidates responded to questions compared to 2020 examination. A significant improvement in candidates scoring between 0 and 20 marks was observed. In section B, candidates have answered two questions as instructed compared to 2020 where some candidates answered all four questions. The fact that candidates have done investigations on various topics as part of School Based Assessment, they were able to relate and effectively deal with questions on research. The greatest concern, however, still remains on candidates's numeracy, problem-solving, practical and spelling skills. The interpretation of questions on command words such as explain, discuss and describe was also a challenge.

Candidates struggle quite a lot in the following topics:

- CBNRM (Community Based Natural Resource Management)
  Candidates do not have the subject knowledge on CBNRM. Attention must be given in this topic because candidates in some centres were unable to answer even a single question in this topic. The same happened in 2020 examination.
- Osmosis
  Candidates do not have a better understanding and knowledge of Osmosis beyond its definition.
- Animal disease
  Candidates lack knowledge on causative organisms of animal's diseases as well as how different diseases spread.
- Plant diseases
  Candidates lack knowledge and understanding of plant diseases.

COMMENTS ON INDIVIDUAL QUESTIONS

1 (a) (i) Well answered, candidates could define enclosed grazing system.

Answer
Grazing system whereby animals graze in a fenced area.

(i) Poorly answered. Most candidates generalized the benefits of enclosed grazing system without referring to environment or linking it to grass.

Answer
- prevents overgrazing;
- prevents erosion;
- allow grass to recover and regrow/better plant diversity and plant production;

(iii) Most candidates could not score full marks because they failed to show how they obtained the answer. Some also gave wrong units (ha) instead of cattle/LSU.

Answer

$\frac{7 \times 45}{15}$; = 21 cattle;

or

$\frac{45\ ha}{15\ ha}$ = 3;

3 x 7 = 21 cattle;

(iv) Well answered. Candidates could identify the correct term.

Answer
A- pasture;

(b) This question was poorly answered. Many candidates do not know how lime can improve the grazing land or how it can influence the soil.

Answer
- help with reversing soil acidification/raises soil pH making it less acidic/decreases acidity in the soil/ neutralise acidic;
- add calcium in the soil;
- decrease the availability of toxic elements;
- increase nutrients availability;
- stimulate microbial or earthworm activities;
- flocculate clay soil/improve the clay soil structure;

(c) Most candidates have identified the correct ways of adding value to given agricultural products.

Answer
fish - canning/drying/freezing/smoking/salting;
grapes - drying/fermenting/extraction/cooking/pressing/processing;
milk - cooling/culturing/ fermenting/pasteurising/churning/skimming/processing;

2 (a) (i) Most candidates correctly identified layer A but confused layer B with either sub-soil or parent rock.

Answer
A – top soil;
B – parent material/semi-weathered rocks

(ii) Most candidates answered the question poorly. They did not understand that lucerne is a legume and therefore could not give its role in terms of improving soil fertility. A good understanding of the role of root nodules found in legume crops was lacking.

Answer
- increase soil fertility;
- fix/add nitrogen in the soil;

(iii) Candidates fairly answered the question. However, those who failed to score a mark were just referring to plant root growing in the soil and no further explanation as to how that action leads to breaking down the rocks.

Answer
- plant roots- they grow into the cracks between rocks;
  as the roots grow bigger/enlarge they force the crack to become wider;
  and pieces of rock break off to form the soil;
- (plant roots) help bind the soil allowing it to increase in depth;
- (plant roots) add to the organic parts of the soil structure assisting crumb formation;
- root respiration adds CO2 to the soil water assisting the chemical breakdown of minerals/rocks;
- humic acid formed when roots decay assists the chemical breakdown of soil minerals;

(b) Poorly answered. Poor understanding or knowledge of the role of inorganic fertilizers and their examples was evident. Candidates could not come up with solutions to correct nutritional deficiencies in plants.

Answer

(i) add limestone ammonium nitrates(LAN)/urea/calcium ammonium nitrates(CAN)/NPK fertilizer 5:1:1;

(ii) add superphosphate/NPK fertilizer 2:3:2;

(c) Candidates could correctly identify the primary decomposer.

Answer
A- bacteria;

(d) Well answered by most candidates.

Answer
- a good crumb structure: ensures free circulation of air in the soil;
- ensures good movement of water in the soil;
- improves water-holding capacity in the soil;
- minimises the rate of leaching;
- minimises soil erosion;
- improved root growth;
- improved growth of soil organisms/microorganisms;

3 (a) (i) Well answered. Almost every candidates correctly identified the process being investigated.

Answer
C- osmosis ;

(ii) The question was fairly answered. However, an in-depth discussion on the osmosis experiment, explanation and link with plant cell should be made for better understanding.

Answer
- Volume of water – decrease/drop
- Volume of concentrated salt solution – increase/rise

(iii) Almost all the candidates had this answer wrong. They could not justify reasons behind the volume of water decreasing and volume of salt solution increasing by making reference to partial permeability. Majority referred to definition of osmosis.

Answer
- the membrane only allows water molecules to pass through;
- but not sugar molecules, because sugar molecules are too large;

(b) Most candidates named two vascular tissues. However, the spelling of xylem and phloem was a challenge to most candidates.

- xylem (vessels);
- phloem (tube);

(c) Fairly answered. Some candidates confused transpiration with respiration while others focus on functions of xylem and phloem.

- maintains water pressure within the cell/maintains turgor pressure/keeps the cell turgid;
- cools the plants/ it controls the temperature of the plants;
- provide water and nutrients to the leaves for photosynthesis/allows water and nutrients to be drawn from the soil into the plant/maintain transpiration stream;

4 (a) (i) Candidates poorly answered this question because they gave general features of an insect-pollinated flower instead of identifying the features shown on Fig. 4.1.

Answer
- large flower;
- thick stigma/stigma inside the flower;
- small firm anther;
- large petals;

(ii) Well answered.

D- self-pollination;

(b) Fairly answered. Most candidates referred to the definition of fertilization of which they could still score two marks. Candidates used wrong concepts for example, they referred to the male and female sex cells **combining/joining** to form **new organism** instead of sex cells/gametes **fusing** to form a **zygote**. Some candidates also referred to the ovary/ovule fusing with pollen grain.

Answer
the tube enters the ovule;
male gamete is released from the pollen tube;
the nuclei from the male and female gametes fuse;
a zygote is formed;

(c) Candidates correctly identify the crop that store starch in the bulb.

Answer
C - onion;

5 (a) (i) Poorly answered. Most candidates could not differentiate between mating, mounting and heat period as many explain what is mating and mounting. Many candidates also do not know which animal goes on heat.

Answer
a period when female animals become sexually receptive / signalling they are ready for mating/ the period when a cow is receptive to a bull;

(ii) Fairly answered. However, some candidates confused signs of heat with mating and signs of birth. The spelling of mounting, restlessness and vulva was challenge. For example, vulva

was spelled as valve by many candidates. Some candidates also referred a bull as a male cow.

Answer
- stand still to be mounted/mounting other cows;
- bellowing;
- restlessness/trailing;
- mucus discharge;
- swelling/reddening of vulva;
- dirty flanks;
- back rubbing;
- sniffing genitals;
- lip curling;
- head raising;
- decreased food intake;
- decreased milk yield;

(b) Well answered

A- luteinizing hormone;

(c) Poorly answered. Majority of candidates gave general nutrients that any animal need without referring to specifically gestation period. Candidates do not understand the difference between nutrient requirements and types of ration as they keep on giving production and maintenance rations as answers. Many candidates also referred to protein needed for foetus formation instead of foetus development/growth.

Answer
- more protein;
  for the growth of the foetus;
- more calcium; for the development of bones in foetus/to increase milk production;

6 (a) (i) Many candidates could identify Y as protein but failed to identify X as minerals/inorganic matter

Answer
X – minerals/inorganic matter;
Y – protein;

(ii) Most candidates answered this question correctly. However, some generalised the importance of water.

Answer
- aid digestion/prevent constipation;
- cool/regulate body temperature;
- help in excretion of waste products;
- help in absorption of nutrients/act as solvent/dissolve nutrients;
- for milk production;
- for lubrication of joints;
- moisture in the food makes it more palatable;

(iii) Most candidates could correctly identify the source of carbohydrates.

Answer
C-maize stalks;

(b) Most candidates misinterpreted the question. Instead of pointing out the correct measures to treat rickets and night blindness, they gave the causes. E.g. they could say rickets caused by "**lack of calcium**".

Answer
- Rickets – mineral licks/calcium/phosphorus;
- night blindness – vitamin A injection/good-quality green fodder mixes;

(c) (i) This question was extremely poorly answered. Most candidates do not know that causative organism is the same as disease causing organism.

Answer
- Bacteria;

(ii) The question was fairly answered. Candidates failed to analyse the information given in the table in order to make a conclusion/obtain answers. Most candidates could not explain why animal 5 that is not treated neither vaccinated is no infected with a disease.

Answer
4 – it was vaccinated;

5 – resistant to diseases/ good immune system;

(iii) Most candidates poorly answered the question. Candidates generalised the answers and some gave the reason as "the farm is overstocked" which is already in the question. They could not explain how overstocked farms encourage infectious diseases to spread.

Answer
- overcrowding;
- high possibility of contact;
- sharing water trough;
- sharing food trough;
- infection disease spread easily through the air;

(d) Most candidates could not correctly identify a disease that is transmitted by a tick. Majority opted for anthrax which is caused by bacteria.

Answer
C - red water fever

7 (a) (i) The majority of candidates were aware that there is sustainability of natural resources. However, most the candidates were not specific that wildlife should be the key word to be included in their answer. Answer provided by candidates were too general for they only mentioned that a group of commercial farmers conserving the natural resources.

Answer
A conservancy consists of a group of commercial farmers / areas of communal land on which members pool resources for the purposes of conserving / using wildlife sustainably;

(ii) Most candidates managed to name at least one or two registered conservancies however some candidates were just writing names of places familiar to them. Example Etosha National Park. Some also referred to Khoadi //Hôas conservancy which is already given as an example in the stem.

Answer
- Nya Nyae;
- Salambala;
- Torra;
- King Nehale;
- Ovitoto;
- Okongo;
- Lusese, e.t.c

NB. Currently, there are about 86 registered conservancies in Namibia.

(iii) Most candidates managed to get at least two marks by mentioning job creation and income generation or sustainability of natural resources. Some candidates confused benefits of communal farmers to that of commercial farmers by mentioning exclusive ownership of wildlife and income generated goes to the owner/individual farmer.

Answer
- sustainability of natural resources;
- communal farmers have certain rights to wildlife;
- employment/job creation;
- communal farmers enjoy the utilization of natural resources/ get meat;
- generate income;

(iv) Most candidates could not answer this question. They simple do not understand what the Namibian law stipulate with regards to protected game in the conservancies. Most candidates did not understand the requirements that conservancies must apply for quotas from Ministry of Environment and Tourism (MET) and in return the MET will then grant/give permission to conservancies stipulating the quota of game to be slaughtered for meat.

Answer
Conservancies need to apply for quotas from the Ministry of Environment and Tourism/GRN regarding the number of game they need to slaughter;
the Ministry of Environment and Tourism/GRN will then give the conservancies the quota of game to be slaughtered for meat;

(b) Most candidates answered this question correctly because the pictures of craft made items are well illustrated.

Answer
A - craft making;

8 (a) (i) This question was fairly answered although some candidates could not correctly identify the farm machinery A. It was referred to as a tractor, plough or planter instead of a combine harvester. As to why it is mostly preferred, most candidates indicated that it is faster but some gave another reason as 'not time consuming' instead of less time consuming.

Answer
A – combine harvester;
performs three operations at the same time/harvesting, threshing and sorting;
cuts labour cost;
saves time/cover a large area within a short period of time/fast;

(ii) Candidates mostly referred the use of spanner as screwing bolts instead of tighten/loosen nuts. On maintenance of the spanner, some candidates indicated that it must be stored in a cool - dry place as if it was a crop.

Answer
use – loosen or tighten nuts;
maintenance – clean after use/add oil;

(iii) Candidates correctly gave the career area that uses the spanner. However, the spelling of engineers and mechanics was a challenge.

Answer
- farm mechanics;
- farm engineers;

(b) Most candidates correctly identified the tap washer as a part that restricts the flow of water in the tap.

Answer
C;

9 (a) (i) Majority of candidates failed to identify the economic principles illustrated on the graph. Some just gave an incomplete answer such as 'diminishing' instead of 'diminishing return'.

Answer
- law of diminishing returns;

(ii) Most candidates correctly identified the units of yield produced from the graph.

Answer
- 2 units of yield

(iii) Most candidates did not obtain a mark because they did not know how to work out the percentage increase in yield. They did not figure out that they supposed to first get the increase in units of yield from point B to C then use the answer obtained to calculate the percentage. The percentage sign (%) was not indicated in some answers.

Answer
1/4 × 100;
= 25%;

(iv) Most candidates scored one mark for suggesting what will happen to the units of yield after point D but failed to justify why yield will start to decline after point D.

Answer
- units of yield will decline;
- too much fertilizer starts burning the roots of crops;
- too much fertilizer alters the soil pH which affects the absorptions of water and nutrients;
- soil microbes cannot work at their maximum;
- Ⓐ yield level off;

(b) Majority of candidates scored maximum marks. However, few did not follow the instruction and they used ruled lines instead of writing the correct letter on the space provided.

Answer
1 - G;
2 - D;
3 - B;
4 - E;

10 (a) (i) Most candidates gave the correct definition of agricultural research. However, some defined research in general without linking it to agriculture. Some candidates confused the definition of agricultural research to that of sustainable agriculture.

Answer
Entails the collection of scientific information about the country's food security and design strategies to solve agricultural problems;; or
any research activity aimed at improving productivity and quality of crops by their genetic improvement, better plant protection, irrigation, storage methods, farm mechanization, efficient marketing, and a better management of resources;; or
a research that provides the public/farmers with better knowledge of farming and technology for productivity improvement;; or
any research activity aimed at improving the productivity and quality of crops or livestock;;

(ii) Candidates were able to list the agricultural research activities but failed to discuss further on how those research activities could lead to the improvement of agricultural commodities.

Answer
research on improved crop varieties: the development of new crop varieties such as cowpeas (e.g Bira and Nakara), sorghum (e.g. Macia) and pearl millet (e.g.Kangara and Okashana number 2) that are more tolerant to drought and pests;
research on animal feeding: this include the supplementary feeding programmes for animals; improved utilization of crop residues as animal feeds;
as well as protein and mineral supplements to correct nutrient deficiencies;
research on animal health: this aim to improve the effectiveness of existing preventative treatment on animal diseases;
and the development of new vaccine;
research on genetic improvement: allows the improvement of crop and animal breed in terms of adaptability, productivity and resistance to pests and diseases;

(b) Candidates failed to read the question fully as they discussed the consequences of genetic engineering in crops instead of livestock.

Answer
- resulted in production of vaccines that protects animals against diseases;
- resulted in increased yield of animal products e.g more milk;
- resulted in producing animals that are adapted to harsh environmental condition;
- improve fertility of livestock;
- improve the quality of animals and their products;
- may result in uncontrollable diseases;
- may result in deformed animals/Mutation;
- may result in allergic reaction once people consumed GM products;

(c) Candidates discussed the benefits of genetic engineering and artificial selection instead of artificial insemination. Some just defined artificial insemination.

Answer
- helps to reduce the risk of spreading venereal diseases;
- cut costs of maintaining a bull;
- semen can be kept and used even after the death of the donor bull;
- improves the quality of livestock by careful breeding/ semen from exotic bulls can be used;
- it reduces injuries caused by big bull mounting small cows;
- allows a quality bull to serve many more cows than would be possible naturally;

11 (a) (i) Although most candidates were aware that during 'leaching' the nutrients are dissolved/drained in the soil, most of them still confused leaching with soil erosion because they mentioned nutrients are washed away instead of nutrients dissolving in water and moved by drainage deep downward into the soil.

Answer
loss of plant nutrients carried by water downward into the soil; away from the reach of plant roots;

(ii) Most candidates managed to get at least two/three marks as they were able to describe how leaching affects the nutrients in the soil in relation to plants.

Answer
nutrients (dissolved in water and) washed downward; mineral salts are leached beyond plant roots;
they are replaced by hydrogen ions, which makes the soil acidic;
plants suffer from nutrient deficiency;

(b) Most candidates provided correct solutions on how farmers can protect the land from erosion.

Answer
- keep soil under vegetative cover;
- use organic materials to improve the soil structure;
- mulch (to reduce splash erosion);
- use contour ploughing;
- use contour ridges;
- windbreaks;
- make terraces;

(c) Although most candidates had an understanding of drip irrigation, they could not fully explain how it operates.

Answer
plastic pipes with small holes/nozzles;
are laid along crop rows;
water drips in the area where plant roots grow/next to the plant;
pipes are connected to the water supply point e.g a tap;

12 (a) Candidates poorly answered the question. Many did not score even a single mark out of four. Most candidates lack knowledge and understanding of the process of osmosis. The use of the correct scientific terminology was a problem as most candidates referred to plant instead of water entering the plant cell. The spelling of turgor proved to be a challenge for most candidates. Some candidates described plasmolysis in plants instead of turgor.

Answer
water enters the plant cell; by osmosis;
vacuole enlarge;
the cytoplasm / cell membrane push
against the cell wall;
cell become firm and turgid;

(b) Candidates only gave the internal parts of the leaf instead of outlining how the leaf adapts to its functions which is mainly photosynthesis.

Answer
leaf has a large surface; – to expose as much of it as possible to sunlight/CO2;
leaf is thin; – to allow gases to easily diffuse through the leaf/shorten diffusion distance;
transparent epidermis with no chloroplasts; – so that light can reach the inner portions of the leaf;
waxy cuticle; - to prevent too much water loss through evaporation;
stomata in lower epidermis; - to allows gases to diffuse in and out;

(c) Correct naming of a bacterial disease was a requirement for a candidates to obtain a mark which most candidates did not do. They also failed to indicate the subheading before giving the answers. Most candidates lack knowledge and understanding of plant diseases.

Answer

Name of disease	Mode of infection	Harmful effects	Prevention and control
bacterial wilt	Soil-borne bacteria spread by water, insects and implements	Rapid wilting; blocked xylem vessels; leaves turn brown;	plant resistance varieties; avoid infected soil; burn infected crops; crop rotation;
bacterial blight	Air-borne spores deposited on the leaves of plant by wind	Foliage begins to wilt; brown patches under the leaves; leaf spotting; blacken stem	Spray the whole crop with Bordeauxix; Seed dressings with copper and bromine; use clean seeds; plant resistant varieties

black rot	Air-borne spores deposited on the leaves of plant by wind	dead tissue at the tips of leaves; block vascular tissues; leaves wilt	crop rotation; clean seeds;

13 (a) Majority of candidates confused dominant and recessive with phenotype and genotype. They could not define them correctly as they keep on referring to strong and weak genes.

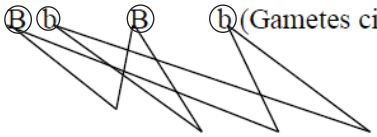
Answer
dominant - describe the genetic trait that expresses itself more strongly than the other in the phenotype **or** a gene that determines the **physical** characteristics of an offspring;
recessive - describe the genetic traits that are hidden/masked by a dominant trait, they are not expressed in the phenotype. or a gene that does not determine the **physical** characteristics of an offspring except in homozygous conditions;

(b) Most candidates could at least score five out of seven marks. Most candidates did not correctly give the parental phenotype as black beside both parents being heterozygous (Bb). Some candidates used different alleles (T/t/W/w) instead of using given allele (B/b). Some candidates did not encircle the gametes.

Answer
parental phenotype : Black × Black;

parental genotype: Bb x Bb ;

Gametes: Ⓑ ⓑ Ⓑ ⓑ (Gametes circled);



Fertilization ;

offspring genotype: BB Bb Bb bb ;

offspring phenotype: black black black white ;

(c) Some candidates referred to general importance of keeping record instead of being specific on financial records as required by the question.

Answer
- enable the farmer to know the financial position of the enterprises;
- enable the farmer to check whether the enterprise is profitable or not;
- enable the farmer to detect problem areas and find the solution in time;
- enable farmers to obtain loan from the bank;
- help in planning;
- help in budgeting ahead for the enterprise;

POSITIVE SUGGESTION TO TEACHERS

- Use activity that will help to improve candidates' numeracy, problem solving and spelling skills.
- Carry out various experiments and practical activities in the syllabus to enhance candidates' knowledge of practical work.
- Train candidates on how to answer examination questions by setting quality assessment. (Tests, tasks, examination, and assignments)
- Candidates should be trained to identify key words when answering questions to avoid generalising of answers. They should also be trained to answer the multiple choice in the space provided rather than encircling the letter.
- Encouraged candidates to familiarize themselves with the glossary of command words at the back of the syllabus and trained how to answer the questions using those command words.
- Use appropriate Agricultural Science terminologies and encourage their candidates to spell them correctly.
- Most importantly, candidates must be encouraged to always go through their work/read what they have written before submitting their papers.