NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

# LIFE SCIENCES: PAPER I

## MARKING GUIDELINES

Time: 3 hours 200 marks

---

**These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.**

**The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.**

---

## Question 1

1.1

| | COLUMN A | | COLUMN B |
|---|---|---|---|
| [ C ] | Scientist who discovered the basic laws of genetic inheritance | A | *Australopithecus sediba* |
| [ D ] | Organisms with similar characteristics that arose from different common ancestors. | B | *Australopithecus africanus* |
| [ K ] | A mechanism that prevents closely related organisms from interbreeding | C | Mendel |
| [ I ] | The position of a gene on a chromosome | D | Convergent Evolution |
| [ F ] | Speciation occurring by quick bursts of evolutionary change followed by long periods of stasis | E | Lamarck |
| [ J ] | Breeding of animals by selecting desired traits over many generations | F | Punctuated Equilibrium |
| [ A ] | The most modern species of *Australopithecus* based on fossil evidence | G | Macroevolution |
| [ B ] | The Taung child is an example of this fossil species | H | Out of Africa |
| [ G ] | Large-scale evolutionary changes that occur over long periods of time that result in new species forming | I | Locus |
| [ H ] | A hypothesis stating that modern humans originated in Africa | J | Artificial Selection |
| | | K | Reproductive Isolation |
| | | L | *Australopithecus afarensis* |

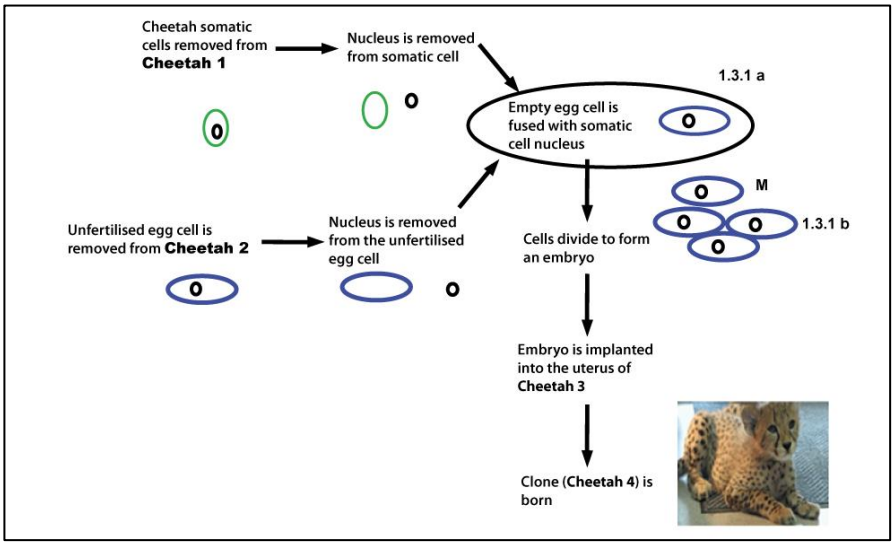
1.2

| Question | 1.2.1 | 1.2.2 | 1.2.3 | 1.2.4 | 1.2.5 | 1.2.6 |
|---|---|---|---|---|---|---|
| Answer | A | A | C | D | D | B |

1.3 1.3.1 (a) Step circled at correct place on diagram (see below). Accept circle only around the cell or the description.

(b) 'M' written at correct place on diagram (see below). Accept M written at cells, or on the description or on the arrows above or below the description.




1.3.2

| COLUMN A | COLUMN B | ANSWER |
|---|---|---|
| To which other cheetah is cheetah 4 genetically identical | A. Cheetah 1<br>B. Cheetah 2 | A |
| The chromosomes number in the nucleus of the somatic cell from cheetah 1 | A. Haploid<br>B. Diploid | B |
| The amount of genetic material contributed by cheetah 3 to cheetah 4. | A. 50%<br>B. 25% | None |
| Disadvantages of cloned individuals | A. Reduced immunity<br>B. Shorter lifespan | Both |

1.4 1.4.1 Primary succession

1.4.2 (a) Bare rock is being broken down/rock is becoming less as sand is formed.

(b) Mosses and lichens / pioneers increase as they colonise / break down bare rock.

OR

The broken-down rock together with the decomposing lichen provides a substrate for mosses and other plants to grow.

1.4.3 A/C

1.5 1.5.1 There is an extra X-chromosome present / there are 2 X chromosomes AND a Y chromosome / there are 3 sex chromosomes / gonosomes instead of 2/ 47 chromosomes are present instead of 46

1.5.2 47/2n + 1

1.5.3 (a) B and C

(b) Failure of chromosomes / a homologous pair to separate / during meiosis / Anaphase 1 / Anaphase 2. This results in daughter cells / gametes with the incorrect number / extra chromosome(s) being produced. The karyotype shows an extra gonosome / extra x chromosome / 47 chromosomes **Any TWO**

1.6.1 Natality and mortality both circled

1.6.2 (a) Stable *choose by ticking the box*

(b) The base of the pyramid is more or less the same size as the middle / reproductive group / more rectangular shape.

OR

The base of the pyramid is not wider than the middle.

OR

The number in the pre-reproductive group is similar to the number in the reproductive group.

OR

First age category (0–4) is slightly smaller than the older age categories (if they choose declining as their option in 1.6.2.a- don't give mark for declining but carry over error).

1.6.3 (a) Yes:
Men in South Africa are more prone to heart disease than women, so more men die young in South Africa.
More men in South Africa are involved in gangs/violent crime which may lead to premature death.
Women less likely than men to engage in risky activities.
Higher levels of testosterone known to weaken heart muscle leading to heart disease in men.
Boys/men only have one X chromosome and are more likely to suffer from sex-linked diseases.
Women have two X chromosomes so sex-linked disorders can be masked if only one copy present.

OR

No.
Gender-based violence in South Africa is higher than most countries which leads to women dying earlier than men.
More women in South African dying of HIV / AIDs / STIs than men.
Any logical/correct ideas. If answer is 'NO' then reasoning must be linked to South African context. Must be well-explained for 2 marks.

(b) 8 200 000 000 × 0,2% = 16 400 000

1.6.4 (a) Yes.
Many different geographical locations are covered.
It takes place over a long period of time.
Professionals who are experts in the field work with the data, and take into account percentage error.
It comes from a government website.
It involves directly counting the majority of individuals

OR

No.
People might lie on the survey.
Homeless people might not be surveyed.
Illegal immigrants might not be surveyed.
People might refuse to take part in the survey.
Difficult to reach areas/rural areas might not be surveyed.
Either TWO reasons OR one reason well-explained.

(b) Yes.
Governments need to know how large a population is in order to plan effectively for infrastructure / schools / hospitals / roads.
The number of people in different socio-economic groups is important to know to adjust tax brackets etc.

OR

No.
It is a developing country/With many people living under the poverty line in South Africa the money could be better spent on housing / job creation / education.
ONE REASON, well-explained.

1.7.1

| **Statement** | **A, B or C** |
|---|---|
| Cerebral volume has increased at a constant rate over the last 4 million years. | B |
| From the graph, it could be deduced that cerebral volume is linked to the development of writing and agriculture. | A |
| The first hominids to be bipedal were from the *Homo* genus. | B |
| *Homo habilis* were the only hominids that used stone tools. | B |
| Changes in teeth shape and size were due to changes in the diet. | C |

1.7.2 Bipedalism allowed hands to be free to make and maintain fire/ use tools Fire allowed more food to be consumed/food more digestible as cooked. More food/calories were available which led to improved brain development.

OR if learner has made the link between bipedalism, brain size and fire making as follows **(any combination of 3 marks)**:

**Bipedalism → Brain size increase:** Upright walking freed hands for tool use, which may have driven brain growth.
**Brain size increase → Fire making:** Larger brains enabled more complex tool use, including fire making.
**Fire making → Brain size increase:** Cooked food supported brain growth, creating a positive feedback loop.
**Bipedalism → Fire making:** Upright walking allowed for more efficient transportation of fire and cooking materials.

1.7.3 (a) P

(b)
- Pelvis is short and wide
- Femur is angled inwards
- Large knee joint
- Big toe parallel to other toes

**Accept any TWO reasons**

1.8.1 A change in a gene / DNA / nitrogenous base sequence.

1.8.2 (a) A substitution has taken place.

(b) Guanine (G) has replaced an Adenine (A) on the third triplet.

1.8.3 (a) Original codon is UUA but mutation codes for UCA.

(b) Original amino acid is Leucine but mutated amino acid is Serine.

1.8.4 (a) Translation

(b) A: Ribosome

D: tRNA

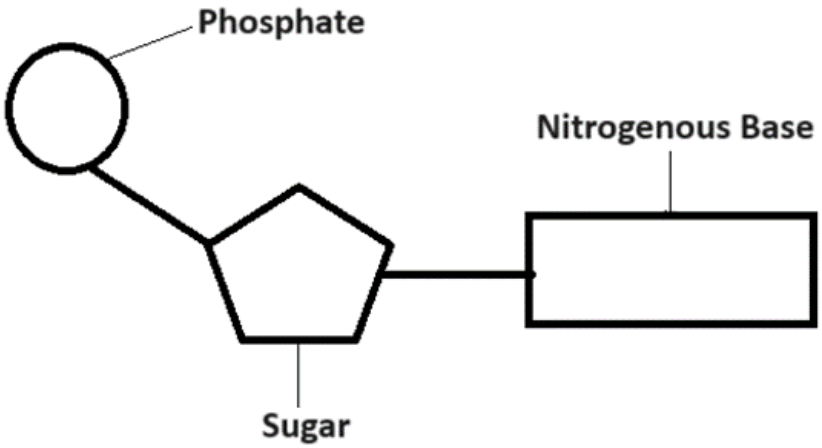
(c) To copy / transcribe the DNA / gene sequence.

OR

Carries / presents the coding sequences / transcripts for protein synthesis.

(d) sugar correctly labelled
sugar molecule joined to Phosphate,
sugar joined to nitrogen base




1.9.1 An investigation into the possible (positive and adverse) effects of a proposed project / building / construction on the ecology / environment / plants and animals etc.

1.9.2 Impacts to biodiversity
Impacts to rock face
Possible pollution impacts
Carbon emission impacts etc.
Impacts aesthetic/natural beauty of an area
**Accept TWO**

1.9.3 Yes.
Reasons from text: increase tourism to the town / job creation
Own reasons: improve economy of area / bring foreign investors into SA.

No.
Reasons from text: destroy natural environment / 37 jobs is not a lot / threaten biodiversity / threaten natural beauty of area.
Own reasons: might affect property values / will use electricity to run / will have a carbon footprint.

Need a combination of own facts and source facts. 2 of own and 1 from source OR 2 from source and 1 from own.

**[80]**

## QUESTION 2

2.1 2.1.1 - Coding DNA / A sequence / section of DNA that codes for a specific protein/trait.

OR

- Short DNA nucleotide sequence that serves as a hereditary unit.

OR

- A unit of heredity.

2.1.2 (a) B *circled* (Autosomal recessive).

(b) Two normal cheetahs have a King Cheetah offspring.

OR

'It contains two copies of a rare gene'

(c) Individuals 1, 2, 4, 7, 9 ANY two correct answers.

(d) bb

2.1.3 **Parent Genotypes:**
Male: Bb Female: Bb (for both parent genotypes)

**Gametes:**
Male: B b Female: B b (mark in Punnet diagram if missing here)

**Punnett Diagram:**

| | B | b |
|---|---|---|
| B | BB | Bb |
| b | Bb | bb |

for top row correct cross
for bottom row correct cross

**Offspring Genotype Ratios:**
25% BB; 50% Bb; 25%bb for all
OR 1BB: 2Bb: 1bb

**Offspring Phenotype Ratios:**
75% regular cheetah: 25% King Cheetah
OR 3 regular cheetah : 1 King Cheetah

2.1.4 Yes.
- It is a means of preserving/preventing extinction of a rare type of cheetah. / This cheetah will add value to tourism and the economy.
- It is educational to teach students about inheritance/genetics using a real-life example.

- Cheetahs in general are quite inbred so breeding a sub-type will not make the gene pool much less diverse than what it normally is.

**Any ONE well-explained (ie. Full bullet point)**

OR

No.
- Selective breeding leads to lack of genetic variation. King Cheetahs will probably have some genetic abnormalities.
- Lethal recessive genes could be passed on by inbreeding.
- Cheetahs are already inbred and so should not be more inbred by selective breeding.

**Any ONE well-explained (ie. Full bullet point)**

2.2.1 DNA fingerprinting/DNA profiling.

2.2.2 Paternity testing / identifying victims of natural disaster / forensic crime scene analysis / identifying poached animals etc.

2.2.3 PCR amplifies the DNA sample - makes more copies of DNA

2.2.4 Horse meat the bands / profile / pattern of sample A match the horse meat sample bands.

2.2.5 (a) Some religions believe it unethical to eat some types of meat so if they are unknowingly eating it, it would go against their belief system.

OR

Consumers have the right to know what they are purchasing and eating.

OR

Some people may have aversions to eating certain meats for example, horses may be considered as pets.

OR

Allergies to certain types of meat could cause harm to person consuming it without their knowledge.

**Any ONE, explained (ie. Full reason as listed)**

(b) Eating meat is for protein/nutrients so it shouldn't matter which meat you are getting it from.

OR

If people eat processed meat, they should know it is not as 'pure' as unprocessed meat.

OR

People who eat meat do not take an ethical stand about killing animals for food so they should not have an issue with which animals are killed.

**Any ONE, explained (ie. Full reasons as listed)**

2.2.6 - Create a law which sees retailers doing this pay a hefty fine.
- Government health/food authorities to regularly inspect / do DNA testing of meat at butcheries / retailers that sell processed meat products.
- Create rules that only certain types of meat may be processed at certain butcheries.

Any ONE practical solution or idea that could prevent the incorrect meat being labelled, etc.,

2.3.1 (a) Hydrogen

(b) Polymerase

2.3.2 It doubles DNA of a cell / creates identical chromatids / chromosomes. This allows each daughter cell / gamete to have the correct amount of DNA / haploid number (23) of chromosomes / passes on genetic information to offspring when they have divided / ensures offspring has the correct number of chromosomes

2.4.1 A project that was undertaken to sequence the entire Human genome / international research effort to map the genes of *Homo sapiens* / human.

2.4.2 (a) Polygenic

(b) Hair colour / texture / eye colour / height / skin colour etc. (accept other correct examples)

2.5.1 Mitochondrial DNA/MtDNA

2.5.2 Does not undergo crossing over: The DNA doesn't change significantly between generations. Low mutation rate so it is easier to trace across multiple generations.

OR

Has a known mutation rate: If the rate of change in the DNA is known then it is easier to predict how old it is/how far back it originates from.

2.5.3 Yes.
It makes science more accessible to everyone.
It makes science relevant.
It helps people understand origins/science.

No.
It radicalises science.
It make science seem more glamorous than what it is.
People who are not qualified might think they are able to be scientists.
It simplifies/trivialises science unnecessarily.
It does not further scientific knowledge/ evidence
It is purely for entertainment value
ANY TWO points or one well-explained for yes or no.

**[40]**

## QUESTION 3

3.1 3.1.1 B

3.1.2 Mating with multiple males in a fertile season

Mating with different males from one season/year to the next

Mating with males from distant locations

3.1.3 (a) Alleles are the same/many traits are homozygous.

(b) Reduction in genetic diversity causes species to have worse chances of survival. Bad recessive genes/lethal genes show more in when homozygosity is high. Less chance of improving survival/genetics / less chance of evolution
***Any TWO***

3.1.4 **Advantage:** increased genetic variation / decrease of lethal recessive genes / increase of favourable genes / increased genetic vigour of organisms

**Disadvantage:** favourable genes may not be passed down / harmful genes might enter the population / loss of desired genotypes / phenotypes / offspring may inherit unfavourable traits

3.1.5 Alleles segregate randomly / independently / in a different order in each cell division homologous chromosomes / maternal and paternal chromatids / arranged randomly on equator in metaphase I move to different gametes / poles in Anaphase I. This increases genetic variation of gametes and offspring / results in gametes with different gene combinations / randomises the combination of alleles in each gamete

3.2.1 To determine the number of fathers to different litters of cheetah offspring.

OR

To determine if female cheetahs mating with many males will assist in increasing the population size

3.2.2 The DNA of the cubs will be compared to each other.

OR

The DNA of the cub is compared to the mother and potential fathers.

3.2.3 Increase the sample size / study more litters of cheetahs / repeat the study / study cheetah litters over a very long period of time / study many cheetah litters from many different mothers over a long period of time.

3.2.4 (3 + 3 + 1 + 2)/4 = 9/4 = 2,25

3.2.5 Yes.
Faeces will always contain DNA.
Faeces is released regularly.
Cheetahs can be under surveillance to ensure correct faeces is collected/studied.

OR

No.
The wrong faeces could be tested.
Faeces could be contaminated by the environment.
Faeces could be decomposing- bacterial DNA could become mixed with it.
Accept other reasonable answers
**Any TWO for yes or no reasons**

3.3.1 The two types of lice have the same host / resource /same blood / food but live on different locations / places / on head and pubic region on the host.

3.3.2 (a) 5,6 million years ago

(b) Pubic lice / *P. pubis*

3.3.3 Scale line = (range of 17 mm to 20 mm)

Line AB = (range of 47 mm to 51 mm)

(47-51 mm)/(17-21 mm) x 0,1= Answer range 0,24 to 0,3
substitutions per site

3.3.4 *Can use any ONE of the following characteristics together with a link to adaptation to the specific environment.*

**Claws:**
Pubic lice claws are thicker/larger and head lice claws are thinner/longer. Their claws need to be able to grip different types of hair.

**Body colour:**
Pubic lice are lighter in colour while head lice are more brown/darker in colour. The lice need to be able to blend in/camouflage into their respective environments/habitats.

**Body size:**
The pubic lice have a larger body size than head lice. This could be due to head lice needing to survive regular brushing/combing of hair and needing to evade the teeth of combs and brushes.

3.4.1 There are a number of birds that have beaks of different depths in the population.

OR

There is variation in the depths of beaks because of variety of foods available.

OR

- Before the drought there many birds with smaller/shallower beaks than after the drought
- There were more finches in the population before the drought than after
- There was a greater range of beak depths before the drought
- The median beak depth before the drought was 9–10mm and the median beak depth after the drought was 10–11mm

3.4.2 Accept range of 72–78 finches

3.4.3 **type of food available** *circled*

3.4.4 (a) Darwin would explain it according to 'natural selection'.
The original finch population had variety in beak depth.
Drought limited the types of food available.
Finches with beaks that can eat the available food were able to eat.
Finches that could eat would survive and reproduce pass on the favourable gene to offspring.
Finches that could not eat would die. The beak size in these birds will not be passed on to other generations.
Over time, the majority of finches would have suitable beaks.
**Any FOUR**

(b) Lamarck would explain it according to use and disuse and passing down of acquired characteristics.
Birds used their beaks more to eat larger seeds.
Due to using the beaks more, they grew larger/increased in depth.
This acquired characteristic was then passed on to next generation.
**Any TWO**

**[40]**

## QUESTION 4

4.1 4.1.1

| Description | Term |
|---|---|
| A grouping that contains a female hyena, her offspring and their children. | Matriline |
| New male hyenas that join a group and go to the bottom of the hierarchy. | Immigrants |

4.1.2 It ensures that the female and her offspring get priority access to resources.

4.1.3 Differences between social organisation of hyenas and wild dogs

| Hyenas | Wild Dogs |
|---|---|
| Alpha female | Alpha male and female |
| Alpha female mates with multiple males/alpha female mates with lowest ranking males.<br>OR<br>Each female with her own matriline mates.<br>OR<br>Preference given to immigrant males for mating. | Only alpha pair breed |
| Eating: dominant female and offspring eat first/immigrant males eat last or not at all. | Eating: all group is fed including sick, old and young |
| Male leaves group when he reaches puberty. | Male stays with group. |

one for each complete comparison across lines (x3). *Comparisons must be direct*
for column headings
for heading
*If not in table format, subtract 1 mark for column headings*

4.1.4 More than one female in each group is able to mate which means more offspring are born.

OR

Hyenas breed with distantly related males / carry out outbreeding which creates better genetic variation / more healthy / more hardy offspring and therefore individuals survive and reproduce.

OR

Wild dogs shot by farmers to protect their livestock and therefore reduced numbers (for reproduction/in populations).

OR

Wild dogs have reduced land area due to urbanisation therefore fewer populations can exist in these areas.

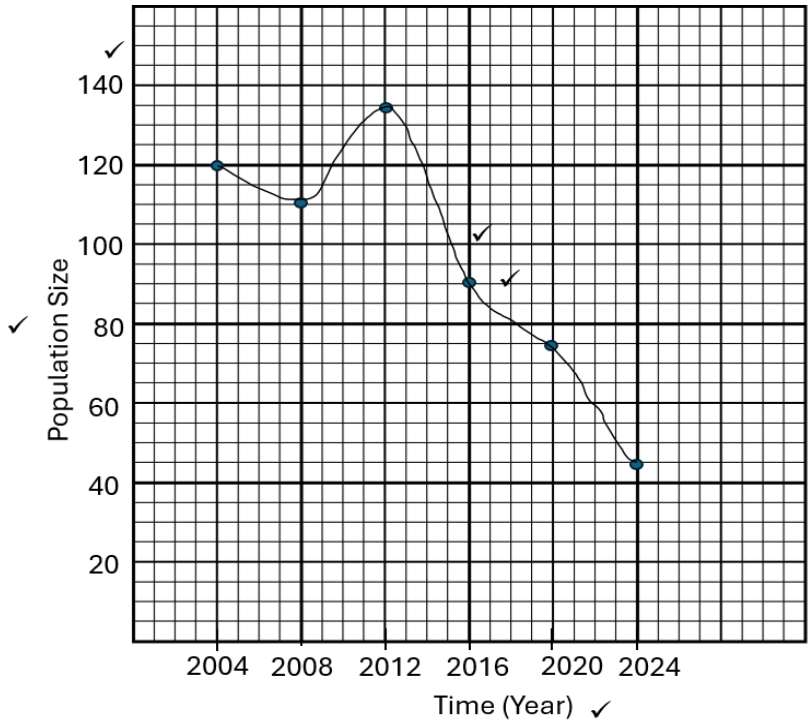
OR

Wild dogs are more inbred than hyenas therefore the reproductive success/survival rate of wild dogs is reduced.

4.2 4.2.1 (a) 2012

(b) More pups born in that year
More prey available
Fewer pups killed by predators
More protection offered to wild dogs by conservationists
Less disease that year
More wild dogs introduced into the protected area
**ANY TWO**

4.2.2 (a) Graph showing the size of a wild dog population/number of wild dogs that are present in an area over a period of 20 years.




Title: graph showing the size of a wild dog population/number of wild dogsthat are present in an area over a period of 20 years
x-axis labelled time (year)
y-axis labelled population size
line graph
appropriate scale (counting upwards in correct increments/ appropriate use of space)
plotting (check 2016:90 point) (7)*If line of best fit is drawn, subtract the mark for 'line graph'*

(b) Check on graph (population size at 2018). Do not award mark if not in range between 75 and 90.

4.3 4.3.1 Species that do not originate/are not naturally found in the given area. / Species that have been introduced to an area by humans. / Species that come from one location/country but live in a different location.

4.3.2 Algae → Tarebia Snail → Fish/birds
order of organisms correct and starts with producer
arrows pointing in correct direction.

4.3.3 (a) Indirect. Snails are not all physically counted / only a sample of snails are taken and a calculation is done based on this / calculation gives an estimate

(b) Capture-mark recapture method

(c) P= (MxS)/T = (52 × 31)/4 = 403

(d)
- Mark should not harm the snails.
- Enough time should be allowed to pass between captures for snails to redistribute.
- Mark should remain on snail for duration of investigation
- Not too much time should pass between captures (for births/deaths to occur).

**Any TWO above**

(e) Quadrat method

(f) Yes.

There are far more alien (Tarebia) snails which means that the aliens will use up the resources that are meant for Bulinus (indigenous snails).
*Comparison of size link to use of resources*

*OR*

No.
This is only one sample and not enough to come up with a conclusion.

There isn't evidence on the condition / state of the different snails so the Bulinus / indigenous snails might still be new to area / reproducing etc.

4.3.4 (a) Interspecific the snails are two different species. / The two snails are not in the same species. / Two different species competing for the same resources.

(b) Density dependent. The more snails in a river / water body / space, the more competition there will be for resources.

4.3.5 Released from an aquarium into a river / lake / dam

**[40]**

**Total: 200 marks**