Life Sciences IEB
Part 2

CLASS TEXT & STUDY GUIDE

Liesl Sterrenberg, Helena Fouché & Grace Elliott

GRADE
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IEB

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Grade 12 Life Sciences 3-in-1 Part 2 IEB

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This book is the second of a comprehensive two-part study guide series which covers the full Gr 12 Life Sciences IEB curriculum. As a pair, the two books cover all the material required for Paper 1 and Paper 2 in your IEB exam. PART 2 guides you methodically through the Environmental Studies and Life Processes in Plants and Animals knowledge strands. PART 1 contains the remaining strands, Life at the Molecular, Cellular and Tissue level and Diversity, Change and Continuity.

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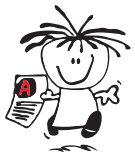

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CONTENTS

NOTES with QUESTIONS:

INTRODUCTION TO LIFE SCIENCES

Life Sciences is the scientific study of living things from molecular level to their interaction with one another and the environment.

- Living systems exhibit levels of organisation from molecules to biomes.
- Life on earth is dynamic, with homeostasis maintaining balance at every level of organisation.
- Life is characterised by changes over time.

How science works

- Fundamental knowledge built on scientific evidence
- Observation
- Designing an investigation
- Making measurements and the importance of scaling
- Presenting data in the form of drawings, written descriptions, tables and graphs
- Identifying patterns and relationships in data
- Societal aspects of scientific evidence
- Limitations of scientific evidence

UNIT 1: POPULATION ECOLOGY

You were introduced to the term **ecology** in Grade 10. **Ecology** is the study of the mutual interaction among living organisms and between living organisms and the environment in which they live.

Population ecology is the part of ecology that focuses on the factors influencing the population size, growth rate, growth forms and distribution of individuals inside a population. In this module you will encounter human population statistics, e.g. size, growth rate and age distribution.

Important terminology

Individual: a single organism that forms part of a species.

Species: a group of organisms with similar characteristics, which produce fertile offspring, e.g. giraffes, rhinos or zebra.

Population: A group of organisms of the same species that are found in a particular area and can crossbreed freely, e.g. the population of giraffes in the Kruger National Park.

Community: a group of populations occurring in a particular area, e.g. the lion, zebra, giraffe and rhino populations in the Kruger National Park.

You could also define a community as groups of different species living in a particular area. Remember, a population is a group of organisms of the same species.

Ecosystem: a unit of plant and animal communities (biotic/living) in interaction with each other as well as with the non-living (abiotic) factors in a particular area, e.g. an ecosystem could be as large as a rain forest or as small as a drop of water in a fish pond.

Environment: the external factors, living (biotic) and non-living (abiotic), surrounding an organism and influencing its development and survival.

Habitat: the specific environment (home) in which a plant or animal species normally occurs.

POPULATION SIZE

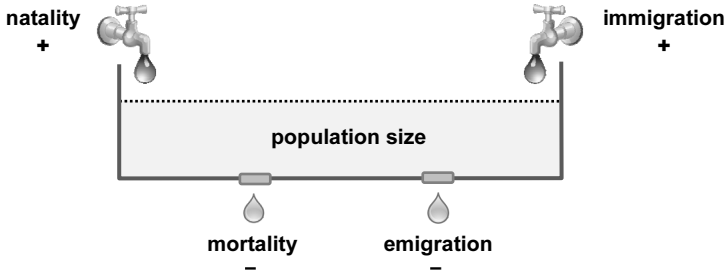
- The **population size** refers to the **total number of individuals** in a population.
- The **population density** refers to the **number of individuals of a population per unit area**, e.g. 10 sheep per hectare (100 m × 100 m).

*Make sure you understand the difference between **population size** and **population density**.*

POPULATION PARAMETERS

- **Four** main factors, known as **parameters**, have an effect on population size:
  - natality
  - mortality
  - immigration
  - emigration

- **Natality** - is the birth rate of a population, normally expressed as the number of live births per thousand individuals per year.
- **Mortality** - is the death rate of a population, normally expressed as the number of deaths per thousand individuals per year.
- **Immigration** - is the one-way movement of organisms into an area where they become established.
- **Emigration** - is the one-way movement of organisms out of an area to become established.



Representation of the four parameters affecting population size

Interpretation of a predator-prey graph

- as prey numbers increase, there is a corresponding increase in predator numbers, because more food is available
- more predation occurs as a result of an increase in predator numbers
- prey numbers decrease
- as the food source diminishes, the predator numbers also begin to decrease
- a decrease in predator numbers leads to an increase in prey numbers
- the cycle is repeated

NB:

- *The graph line of the prey population always peaks first.*
- *The peaks of the two graph lines never overlap. The predator graph follows the prey graph after a short delay in time.*

Examples of South African predator-prey relationships

Lion - zebra

- Lions, with their unbelievable power, agility, sharp teeth, claws, keen sight and camouflage, are well-adapted to be successful hunters.
- Lions live in savannah, grassland and open bushveld which provide excellent cover for stalking their prey e.g. zebra.
- They hunt in the bushveld during the day where there is more tree cover in daylight hours, but they are more active in the open grasslands at night where they can use speed and when their prey cannot detect them as easily.
- They target the old, frail, injured, weak or very young prey that are easier to catch and have a higher risk of dying from disease or hunger.
- The lion's prey e.g. zebra are also well-adapted to avoiding predation by means of various strategies.
- Zebra graze in open grasslands during the day so that they can detect approaching predators. They graze in bushveld at night where predators cannot stalk them quietly and at high speed.
- Zebra move more erratically at night when lions are more active, making it more difficult to locate them in the dark.
- Zebra have a good sense of sight, smell and hearing to avoid predators.
- They have a particularly effective camouflage of stripes that blends in with the surrounding vegetation, particularly in herds.
- Zebra form herds for effective protection. Herds also provide early warning systems of predators in the area. If the predator charges, the individual members of the herd have a better chance of survival when they scatter in different directions.
- Zebras are mammals with high parental care and all the herd members will keep a protective eye over the younger members of the group.

Ladybird - aphid

- Ladybirds are insect predators that feed on aphids.

Not all ladybirds are predators of aphids; some species are harmful to plants and can cause considerable damage.

- Aphids are garden pests that suck plant sap and transfer viral diseases and toxins into the plant which cause abnormal plant growth.
- They release a sweet liquid called honeydew which encourages the growth of black fungus that destroys the plant.
- Ladybirds are introduced into crops or gardens deliberately to control the natural enemies of aphids and can eat up to 1 000 aphids per day.
- Ladybirds are deliberately introduced into crops or gardens to control aphid populations. They do not destroy them completely, but exhibit a typical predator-prey relationship and keep the aphid population at manageable levels.
- The control of a pest by another organism is known as biological control. It is an environmentally friendly method of combatting pests.

Biological control? *The control of a pest population using a living organism that is a natural enemy of the pest. Biological control avoids the use of toxic pesticides and controls the pest population naturally.*

IMPACT OF FOOD WEBS AND SOCIAL ORGANISATION ON POPULATIONS

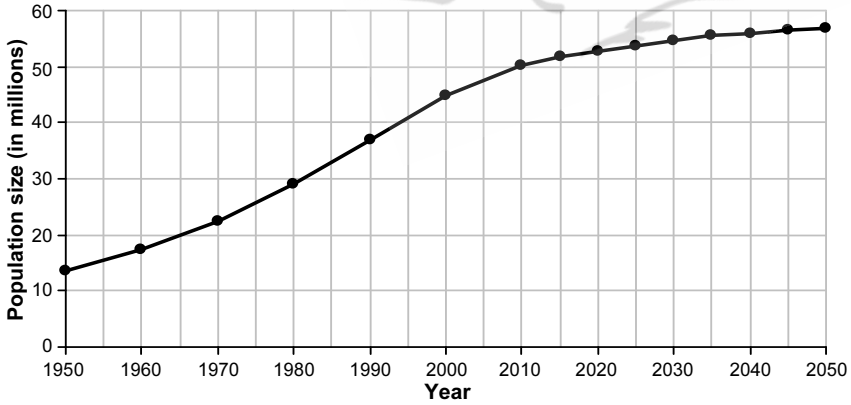
- The food chain ensures that the organisms lower down on the feeding hierarchy are more numerous, whereas top predators are small in number as they consume large quantities of prey.
- Top predators stabilise the populations of herbivores, thus giving the producer populations opportunity to recover and multiply.

*A **top predator** is an animal at the top of the food chain. Top predators have few or no natural enemies.*

HUMAN POPULATION GROWTH IN SOUTH AFRICA

- According to the results of the recent census, South Africa's population size was 51,7 million in October 2011.
- This indicates an increase of 15,5% in the population (nearly 7 million people) over the past 10 years since the previous census in 2001 when 44,8 million people were counted.
- The following table and graph show the human population of South Africa from 1950 and estimated to 2050.

Year	Population size (in millions)
1950	13,70
1960	17,40
1970	22,50
1980	29,10
1990	36,80
2000	44,70
2010	50,10
2015	51,90
2020	52,70
2025	53,80
2030	54,70
2035	55,50
2040	56,00
2045	56,50
2050	56,80



- If one studies the data, which consists of actual and estimated values provided above, it is evident that there is a decrease in growth rate after 2010.

It is clear that the graph becomes less steep after 2010 as a result of the decreasing rate of population growth.

- The decrease in the rate of population growth can mainly be attributed to large numbers of HIV-related deaths in South Africa.
- In 2008, an estimated 250 000 South Africans died due to HIV/Aids-related diseases and 20% of the adult population was infected by HIV - more than any other country in the world.
- South Africa is moving from a high rate of population growth, characteristic of less-developed countries, to a more stable rate of population growth which is characteristic of more-developed countries.
- This could possibly be ascribed to the gradual decrease in both the birth rate and the death rate.
- It is also possible that a cure could be developed for HIV/Aids.
- The fact that South Africa is becoming increasingly more developed, with improved education, a higher standard of living and better health care, also plays a role.

Information regarding future population figures is simply predictions, estimates and assumptions made by demographers and based on present trends and conditions. It is therefore possible that the actual outcome could be different.

The increase of the world's human population results in a drastic increase in the consumption of natural resources, the generation of waste and the pollution of the environment. The impact of increasing human population figures is so great that human consumption is affecting climate, ecosystems and resources worldwide. Another cause for concern is the imminent food insecurity that poses a real threat to humans in the near future.

Ecological footprint (EF)

The human demands placed on the environment can be measured by means of an **ecological footprint** (**EF**).

The ecological footprint measures the amount of biologically productive land and water required to regenerate the resources consumed by the human population, and to absorb and detoxify the human waste produced.

Biocapacity is defined as the amount of land and water available on earth to provide resources and absorb waste.

The ecological footprint can be calculated for an individual, a population, city, business or all of humankind as well as for a human activity.

Biologically productive areas include:

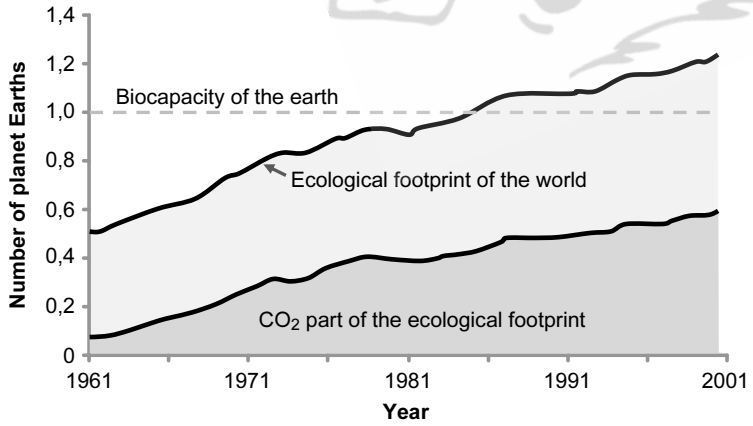
- arable land
- grazing
- forests
- built-up areas
- fossil fuel/mining areas
- fishing waters

NB: *Deserts, glaciers and the open sea are not considered biologically productive.*

Ecological footprints and biocapacity are measured in **global hectares (gha)**. One global hectare represents one hectare (ha) of biologically productive land or water (1 ha = 100 m × 100 m).

The global hectare per capita (per person) of a specific area is calculated by dividing the total ecological footprints of the area and/or biocapacity by the population size.

The comparison of the ecological footprint with the earth's biocapacity gives an indication of **environmental sustainability**. If humankind needs more than the biologically productive land and water available, the rate of consumption is not sustainable. The human ecological footprint first surpassed the earth's total biocapacity in the 1980s.



The smaller the ecological footprint with regard to biocapacity, the more sustainable the environment.

The average ecological footprint of the world in 2006 was 2,6 gha/person and the average biocapacity about 1,8 gha. The lifestyle of the average world citizen is therefore unsustainable and natural resources are being used up faster than they can be generated. This phenomenon is known as **ecological overshoot**.

The consequences of ecological overshoot include:

- collapse of fish stocks
- decreased forest covering
- depletion of freshwater sources
- accumulation of pollution and waste, resulting in climate change

Humankind currently uses the equivalent of 1,4 earth-sized planets to provide the resources we use and to absorb the waste we create. This means that it takes planet earth 1 year and 5 months to regenerate what we use in 1 year.

Ecological footprint and biocapacity of different countries

Country	Ecological Footprint (global hectares per capita)	Biocapacity (global hectares per capita)
United Arab Emirates	10,3	1,4
USA	9,0	4,0
Germany	4,0	1,9
United Kingdom	6,1	1,6
South Africa	2,7	1,7
Angola	1,0	3,0
Madagascar	1,2	3,2
Congo	1,0	13.3

It is clear from the table above that the ecological footprints of more-developed countries such as the United Arab Emirates, USA, Germany and the United Kingdom, are much bigger than their own biocapacity. Resources are therefore mainly acquired from other countries, placing them, in turn, under increasing pressure.

QUESTION 10

Define the following concepts:

10.1 community
10.2 trophic level
10.3 producers
10.4 consumers
10.5 primary consumers
10.6 secondary consumers
10.7 tertiary consumers
10.8 decomposers

QUESTION 11

11.1 List FIVE types of interactions that occur in communities in natural environments.

11.2 Why are these interactions between individuals in communities in natural environments of vital importance?

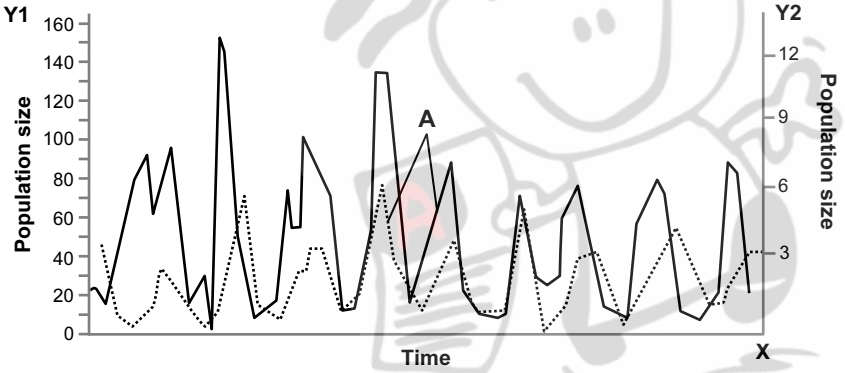
11.3 Define the concept *predation*.

11.4 List FOUR adaptations of predators that enable them to successfully hunt and catch their prey.

11.5 List FOUR adaptations of prey that help them to escape their predators.

QUESTION 12

Study the graph below showing the relationship between lynx and snow hare populations, and answer the questions that follow.



12.1 Identify the relationship represented by the above graph.

12.2 Would you regard this relationship mentioned in Question 12.1 as a density independent or density dependent factor? Give a reason for your answer.

12.3 Which graph (solid or dotted line) represents the snow hare population? Give THREE reasons for your answer.

12.4 Which of the axes - Y1 or Y2 - indicates the population size of the snow hares? Give a reason for your choice.

12.5 How many snow hares were present when the lynx population was at its peak?

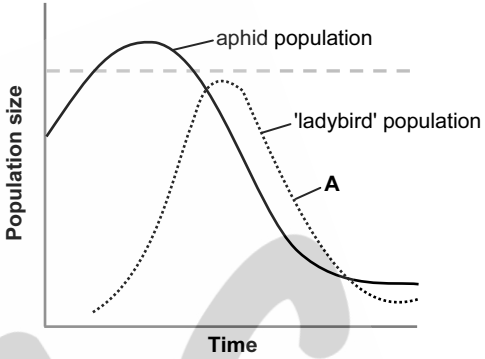
12.6 Describe the trend each time the number of prey increases.

12.7 Explain the reason for the trend mentioned in Question 12.6.

12.8 Explain the connection between the declining lines of the two graphs, as represented at A.

QUESTION 13

Study the following graph representing biological control and answer the questions that follow.



13.1 Biological control introduces a natural enemy to control the numbers of a specific pest when the pest population increases to harmful levels. According to the graph, which type of feeding relationship exists between the natural enemy and the pest?

13.2 Which of the populations, aphid or ladybird, would you identify as the predators? Give a reason for you answer.

13.3 Why do you think the ladybirds' graph does not start at 0 on the x-axis?

13.4 What is represented by the horizontal dotted line on the graph?

13.5 Discuss the trend in the population numbers as represented at A.

QUESTION 14

Species A, B, C and D are different heterotrophic organisms in the same food chain in an ecosystem. The table below shows the population numbers of each species at the same point of time on a summer day. Study the table and answer the questions that follow.

Species	Population numbers
A	847
B	116
C	85
D	6

14.1 Which one of the following three statements is TRUE?

A The population number of species A is the highest, because they can produce their own organic food.

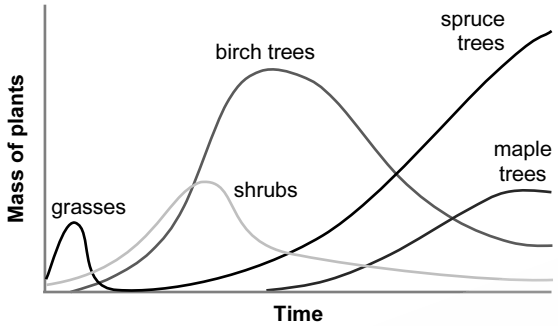
B Species B probably feeds on species D.

C Species D is probably the top predator in the food chain.

14.2 Why can statement A not be TRUE?

QUESTION 22

Study the graph below and answer the questions that follow.



22.1 Which phenomenon is represented in the above graph?

22.2 Which plants settled here as the pioneers?

22.3 Which trees settled in the area first?

22.4 Which trees settled in the area last?

22.5 Which trees form part of the final, stable community of this ecosystem?

22.6 Which term is used for this final stable community, mentioned in Question 22.5?

22.7 Which type of plant in this community became extinct after a little while?

22.8 Did the shrubs in this community die out completely? Give a reason for your answer.

22.9 Which plants all form part of the climax community of this ecosystem?

22.10 Why does secondary succession take place much faster than primary succession?

QUESTION 23

A permanent, rocky island appeared as the water of the ocean receded over time.

23.1 What type of ecological succession will take place here?

23.2 Which of the following plant groups will probably settle here first?

A low trees **B** shrubs

C lichens **D** weeds

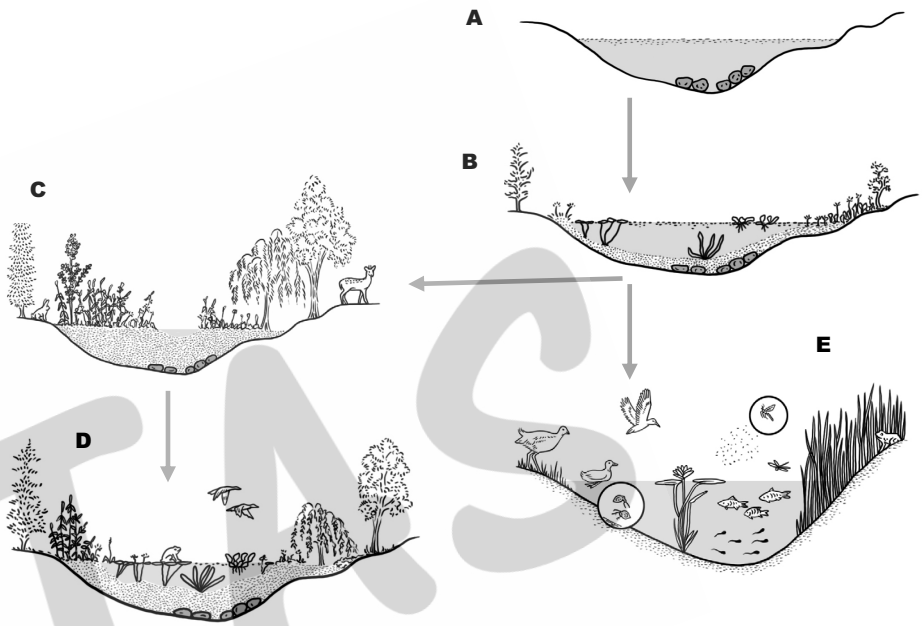
23.3 Give a reason for your answer in Question 23.2.

23.4 Explain what a lichen is.

23.5 In which order will these four plant groups settle in the new area?

QUESTION 24

Study the representation below and answer the questions that follow.



24.1 What type of ecological succession is represented here? Give a reason for your answer.

24.2 Which TWO types of plankton are represented in A and B?

24.3 What is the role of the plankton in this ecological succession?

24.4 The succession in this representation could run its course from A to D, or from A to B and then E. What are the representations labelled D and E called in the process of succession?

24.5 Explain the progress of the succession from A to D.

24.6 How could succession follow another direction (from A to B and then to E) and eventually lead to a climax where a stable aquatic ecosystem develops?

24.7 Would you say that both D and E could be considered successful climaxes to this process of primary succession? Explain your answer.

20.3.2
- The large number of zebra in the herd can detect a lion quickly, as there are 'many eyes and ears' in the herd.
- The fleeing herd can move as a unit, where every individual tries to minimise danger to itself by trying to stay as close to the centre of the herd as possible.
- The fleeing herd can also scatter in all directions and so make it difficult for a lion to focus his/her attention on one moving target.
- The disruptive colouring of zebra presents the lion with a confusing image and makes it difficult to pick out individual prey.

20.4 co-operative hunting

20.5 It refers to animals that reach the highest level of social organisation in a community.

20.6 Such a colony of animals usually has a single dominant, fertile female individual (queen) and several male individuals able to reproduce actively. The rest of the colony consists of different groups (castes) carrying out specialised tasks.

QUESTION 21

21.1 The succession of communities, where one community replaces another over time, leading to long-term changes in the ecosystem.

21.2 The pioneers are the first plants and animals to settle in an area, e.g. grasses or lichens. The climax is a complex, stable ecosystem, the end result of the changes during succession, e.g. a forest.

21.3.1 It takes place when plants and animals settle for the first time in an area where previously no life existed. This usually occurs in areas where initially there is no soil, for example, on bare rocks, sandy surfaces, areas with lava deposits or in newly formed dams or lakes.

21.3.2 This takes place when plants and animals settle in an area disturbed by human activities (e.g. ploughed fields or deforested areas) or natural disasters (e.g. bush fires or floods).

QUESTION 22

22.1 ecological succession

22.2 grasses and shrubs

22.3 birch trees

22.4 maple trees

22.5 spruce, maple and birch trees

22.6 climax/final point

22.7 grasses

22.8 No. The graph line does not extend to the x-axis, in other words to 0.

22.9 shrubs, birch trees, maple trees and spruce trees

22.10 The area where the pioneer species settle, already has soil, organic nutrients and seeds from previous vegetation.

QUESTION 23

23.1 primary ecological succession

23.2 C - lichens

23.3 Primary succession on bare rocks usually starts with lichens, as the fungus can survive extreme conditions and facilitate soil formation, provides a growth medium for the next plant group.

23.4 A lichen is a plant-like growth consisting of a symbiotic relationship between a fungus and green algae. The fungus provides inorganic nutrients and protection against extreme conditions, while the green algae photosynthesise and provide organic nutrients.

23.5 lichens, weeds, shrubs, low trees **or** C, D, B, A

QUESTION 24

24.1 Primary ecological succession. The succession starts at a newly formed pond/dam.

24.2 microscopic plants (phytoplankton) and animals (zooplankton)

24.3 pioneers/pioneer communities

24.4 climax/final point

24.5 Plankton are the pioneers in the newly formed pond. As the plankton dies, sediment is formed and small organisms can begin to settle there, for example snails, small fish and tadpoles.

As the sediment accumulates and becomes denser, soil is formed, in which small water plants can settle in the shallower water along the edges of the pond. Small animals begin to live in and around the pond, for example, frogs, rabbits, grasshoppers and dragonflies. Vegetation gradually increases and plants floating on the water, such as water lilies, start growing. Animal life also increases. The pond gets shallower and becomes marsh-like. The water plants and animals become fewer, and a land ecosystem begins to form. Shorter shrubs and trees begin to settle, with a specific animal life of insects, birds, rabbits, lizards and small antelope. Eventually tall trees settle there as part of a forest-like climax, with a variety of birds and larger land animals.

24.6 It could happen if the pond remains sufficiently deep. Then there could be enough water movement and even wave action when the wind blows, resulting in the erosion of the pond's banks and the pond becoming deeper. This in turn will result in the settling of more and more water animals, for example, larger fish, crabs and ducks, as well as bigger water plants, e.g. reeds and bulrushes, that will in turn attract more birds, e.g. weaver birds.

24.7 Yes. Both are stable, mature ecosystems with a variety of plants and animals at all trophic levels, living in successful interaction with the abiotic environment.

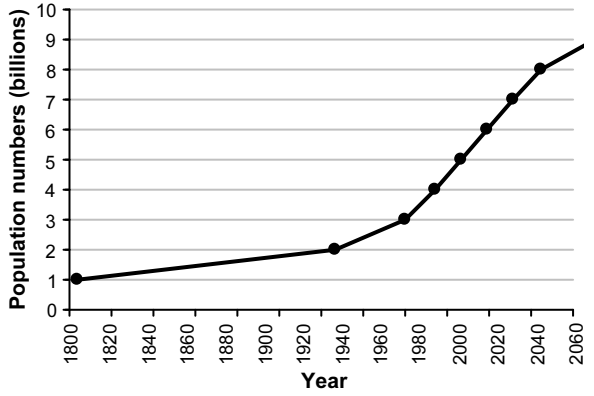
QUESTION 25

25.1.1 123 years

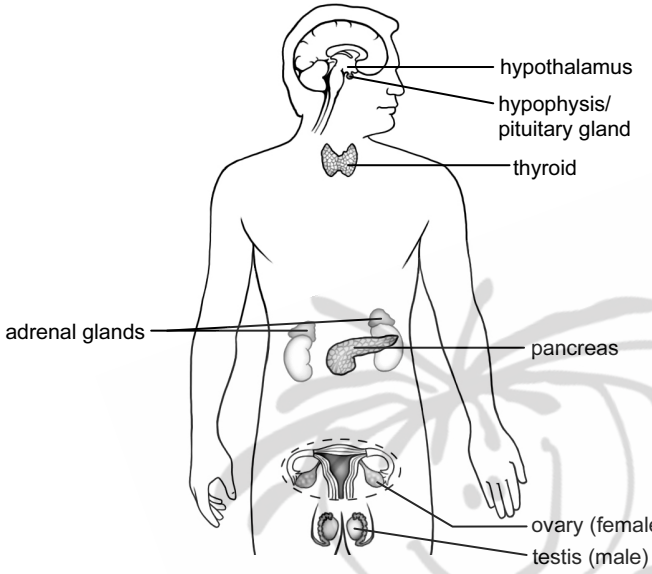
25.1.2 47 years

25.1.3 51 years

25.2



ENDOCRINE GLANDS AND THEIR HORMONES



Position of the endocrine glands in the human body

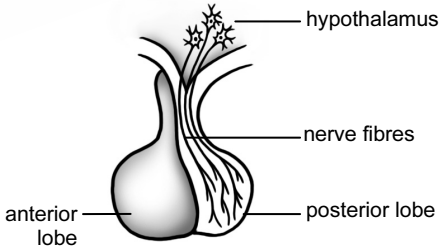
HYPOPHYSIS/PITUITARY GLAND

- The hypophysis is located at the base of the brain, attached to the **hypothalamus** by a short stalk. It fits into a small bony cavity in the cranium.

The hypothalamus is a part of the brain located just below the corpus callosum and it controls the functions of the hypophysis. It is the link between the nervous and endocrine systems.

- The hypophysis consists of two lobes:
  - **Anterior lobe (adenohypophysis)**
  - **Posterior lobe (neurohypophysis)**

*The hypophysis was originally known as the **'master gland'** of the body, because it secretes many hormones that affect many of the other endocrine glands.*



Hypophysis

Relationship between the hypothalamus and the hypophysis

- The hypothalamus is connected to the hypophysis in two ways:
  - by blood vessels to the anterior lobe
  - by neurons to the posterior lobe
- The hypothalamus produces hormones (e.g. ADH) which are transported via the neurons to the posterior lobe of the hypophysis for storage.
- The hypothalamus controls the hypophysis by secreting releasing factors via the neurons (to the posterior lobe) or via the blood (to the anterior lobe). The releasing factors stimulate the hypophysis to produce and/or release hormones into the blood.

Hormones of the anterior lobe

TSH (thyroid stimulating hormone)

- TSH stimulates the thyroid to secrete the hormone thyroxin.

*TSH and its role in a negative feedback mechanism is discussed under the heading **Thyroid** on p. 2.5.*

Growth hormone (STH/somatotropic hormone)

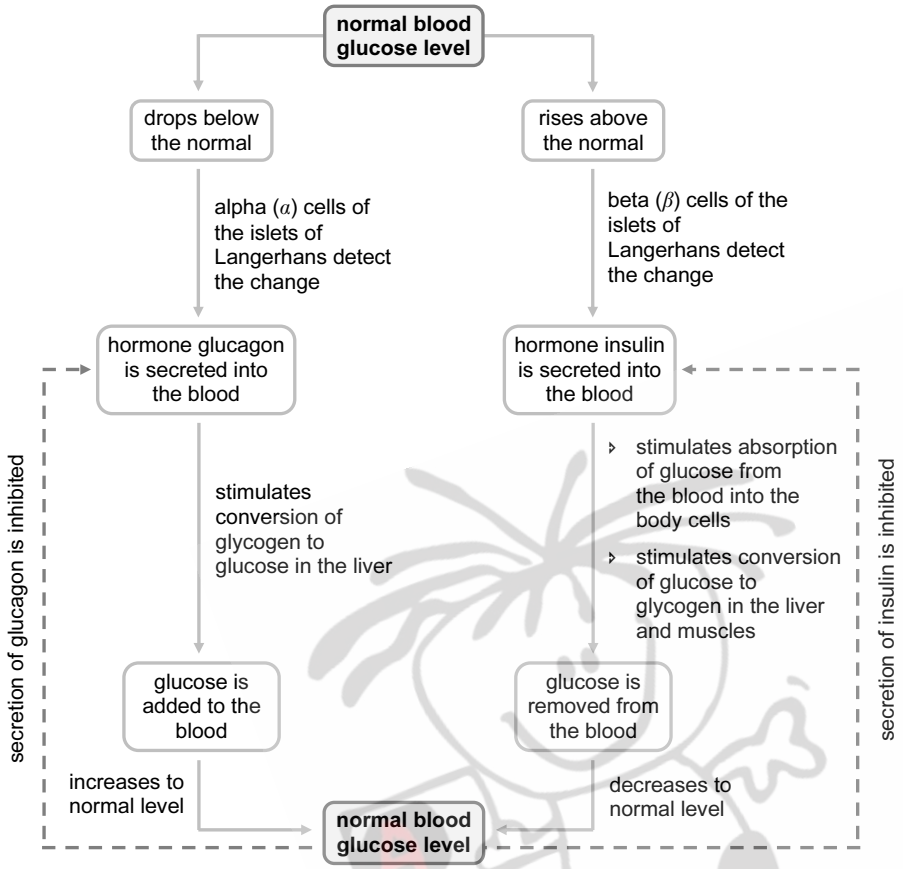
- Growth hormone promotes the growth of the skeleton and muscles by stimulating the synthesis of proteins.
- **Growth disorders**
  - Growth disorders are caused by the abnormal secretion of growth hormone.

under-secretion = hyposecretion
over-secretion = hypersecretion

  - The under-secretion of growth hormone in children causes **dwarfism**. The body is very short, with body parts in proportion. Mental ability is normal, but the person does not reach sexual maturity.

NB: *Some cases of dwarfism are genetic conditions. In these cases, body parts are out of proportion, for example, a normal sized head and torso with short arms and legs.*

  - The over-secretion of growth hormone in children causes **gigantism**. Usually this condition is the result of a tumour in the hypophysis. The over-secretion of growth hormone in adults causes **acromegaly**. The long bones in the body have completed growth and cannot lengthen anymore. The growth plates in the epiphyses of the long bones close during puberty. The bones of the face, especially the jawbone, and the hands and feet increase in size.



Regulation of glucose in the blood

Diabetes mellitus

- Diabetes mellitus is a metabolic disease that is characterised by high glucose levels in the blood.
- It is a chronic disease that cannot be cured.
- Under normal conditions glucose levels in the blood are kept constant by the hormones insulin and glucagon.
- Insulin stimulates the absorption of glucose from the blood to the body cells.
- However, when insulin is absent or does not function effectively, most of the glucose remains in the blood.
- This causes an increased blood glucose level that is called **hyperglycaemia**.
- Consequently, the body cells do not receive enough glucose for cellular respiration which releases energy for body functions.
- The following **symptoms** result:
  - frequent urination (especially at night)
  - increased thirst
  - increased hunger
  - inexplicable weight loss
  - repeated infections
  - wounds that heal slowly
  - impaired vision
  - exhaustion and dizziness

- High blood glucose levels cause cells to lose water by osmosis, resulting in dehydration.
- The person may fall into a coma and organs may be damaged beyond repair.
- Long-term complications of diabetes include blindness, kidney failure and cardiovascular diseases.
- Two types of diabetes are distinguished, Type 1 and Type 2.
- **Type 1 diabetes** is characterised by the loss of insulin-producing beta cells in the pancreas. This may be due to the body's immune system attacking and destroying its own beta cells. Little or no insulin is produced.

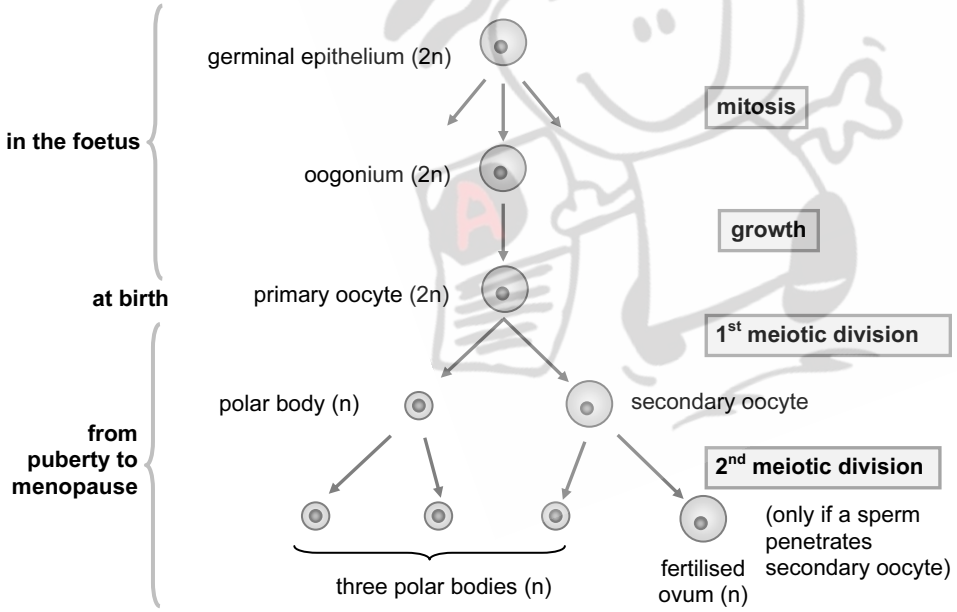
  Treatment and management
  - daily insulin injections
  - a specially adapted diet
  - regular testing of blood sugar levels

- **Type 2 diabetes** is characterised by **insulin resistance**, where the pancreas produces insulin, but the body cells cannot use it effectively. Type 2 diabetes is seen as a lifestyle disease and its causes include the following:
  - overweight and obesity
  - inactivity
  - age

At puberty:

- The primary oocyte (2n) undergoes **meiosis**, and after the first meiotic division each gives rise to a larger, **haploid secondary oocyte** and a smaller, **haploid polar body**.
- The secondary oocyte (n) is released from the ovary in a process called **ovulation**.
- The second meiotic division only occurs if a sperm fertilises the secondary oocyte (n).
- After the second meiotic division, the secondary oocyte (n) divides into two daughter cells: a larger **haploid ovum** and another **polar body (n)**. Sometimes the first polar body also divides to form **two polar bodies**.
- Oogenesis thus produces **four haploid cells**, i.e. **three polar bodies** and a **haploid ovum**.

Of the four cells formed only the larger ovum survives. The smaller three polar bodies degenerate and disappear.



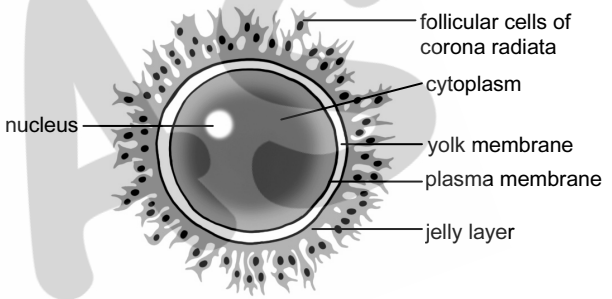
Diagrammatic representation of oogenesis

*This process is discussed in more detail in the section on the **Menstrual cycle and hormonal control**.*

Structure of the ovum (egg cell)

The ovum is one of the largest cells in the body. It has a haploid **nucleus** with 23 chromosomes. The **cytoplasm** of the ovum is known as the **yolk** and provides a reserve source of nutrients for the fertilised ovum. The cytoplasm is enclosed by a **plasma membrane**.

Surrounding the plasma membrane is the vitelline or **yolk membrane**, which becomes impermeable after fertilisation and thereafter it is known as the **fertilisation membrane**. A **jelly layer** surrounds the yolk membrane and remains for some time after fertilisation. It provides protection to the early developmental stages of the fertilised egg cell. An outermost granular layer, called the **corona radiata**, consists of follicle cells that surrounded the secondary oocyte prior to ovulation. During fertilisation it is dissolved by enzymes that are released by the sperm.



MENSTRUAL CYCLE AND HORMONAL CONTROL

*The menstrual cycle of the female consists of the **ovarian** and **uterine cycles** and progresses over a period of about 28 days.*

Ovarian cycle

- There are cyclical changes in the ovary, known as the ovarian cycle. The following changes are discussed below:
  - Development of the primary follicles into mature **Graafian follicles** (day 1 - 14)
  - Rupturing of the follicle and release of the immature ovum in **ovulation** (day 14)
  - Formation of the **corpus luteum** (from day 15)

See the section through the ovary on p. 2.33.

QUESTION 6 - *enrichment*

Study the illustrations of young animals below and answer the questions that follow.

A 

B 

C 

D 

6.1 Identify the developmental strategy exhibited by each of the animals labelled A to D respectively.

6.2 What type of bird has chicks that, when hatched, will display the developmental stage indicated by:

6.2.1 chick A? 6.2.2 chick B?

6.3 Compare, in table form, the developmental strategies as represented by chicks labelled A and B respectively by referring to:

6.3.1 incubation period 6.3.2 structure of eggs

6.3.3 hatched chicks 6.3.4 parental care

6.4 Tabulate the developmental strategies as represented by the mammal species labelled C and D respectively by referring to:

6.4.1 examples of animal species that exhibit this development strategy

6.4.2 the gestation period

6.4.3 the young after birth

6.5 Compare the young of precocial and altricial animals with respect to their chances of survival to reproductive age.

QUESTION 7

7.1.1 Define the concept *parental care*.

7.1.2 Discuss the energy input that is associated with parental care.

7.2 Name FIVE examples of parental care.

7.3 Which group of vertebrates exhibit

7.3.1 the least, if any, parental care?

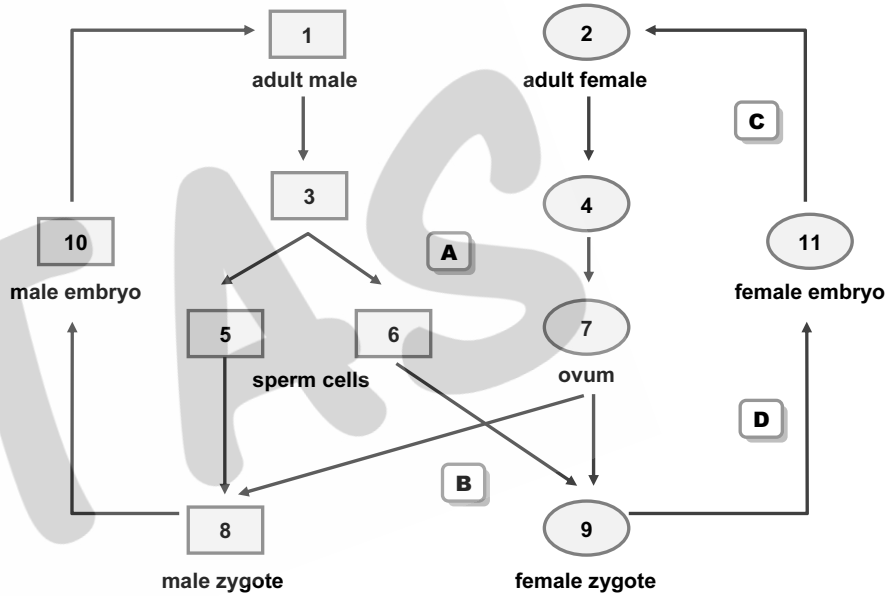
7.3.2 the greatest measure of parental care?

7.4 'In humans parental care includes far more than simply the physical rearing of the child.' Briefly explain this statement.

UNIT 4

QUESTION 1

Study the schematic diagram of the life cycle of humans below and answer the questions that follow.



1.1 Identify the organs numbered 3 and 4 respectively.

1.2.1 Identify the cell division process labelled A.

1.2.2 What is the biological importance of this process?

1.3 Name the process which forms:

1.3.1 sperm 1.3.2 ova

1.4 Identify the ...

1.4.1 process labelled B.

1.4.2 cell division process labelled C.

1.5 What would the chromosome number be (2n or n) in a cell nucleus in the part that is numbered ...

1.5.1 2; 1.5.2 3; 1.5.3 6; 1.5.4 9; 1.5.5 10?

14.7.1 Identify the part numbered 10.

14.7.2 Which changes occurred in the part mentioned in Question 14.7.1 to prepare it for implantation?

14.7.3 Which hormones were responsible for these changes mentioned in Question 14.7.2?

14.7.4 Identify the process represented by C.

14.7.5 Identify the structure numbered 11.

14.7.6 These structures, mentioned in Question 14.7.5, later form part of the .....

14.8 What will happen to each of the following should fertilisation not occur?

14.8.1 progesterone level 14.8.2 corpus luteum

14.8.3 menstrual cycle 14.8.4 follicle development

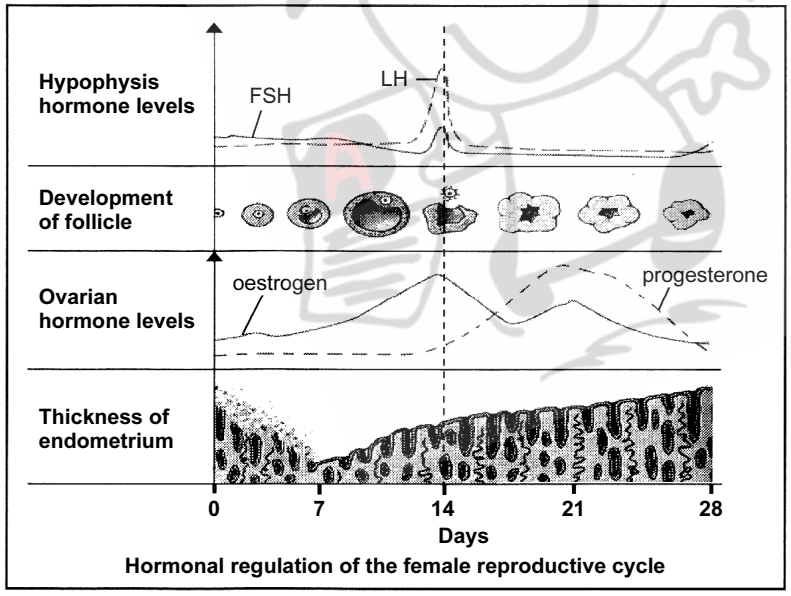
14.9 What happens to each of the following if fertilisation does occur?

14.9.1 progesterone level 14.9.2 corpus luteum

14.9.3 menstrual cycle 14.9.4 follicle development

QUESTION 15

Study the diagram illustrating a menstrual cycle below and answer the questions that follow.



Hormonal regulation of the female reproductive cycle

15.1 On which day does ovulation take place?

15.2 Between which days does menstruation take place?

15.3 State ONE function of FSH during the menstrual cycle.

15.4 Describe the functional relationship between progesterone and FSH.

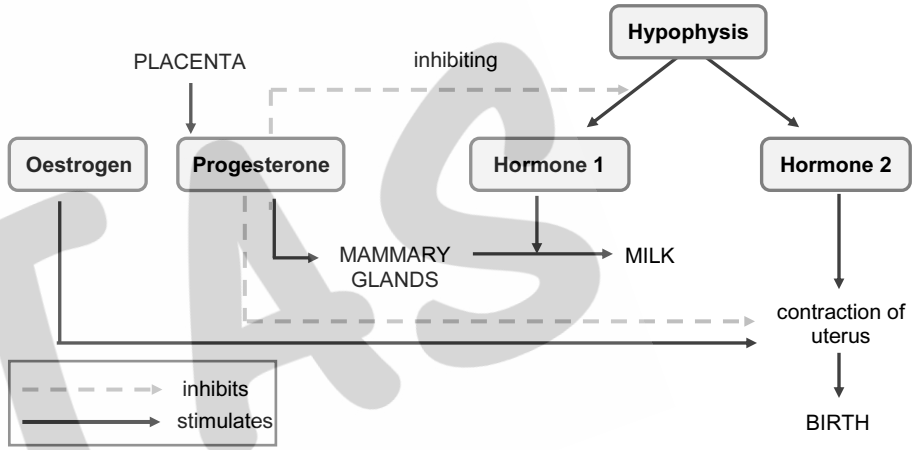
15.5 Account for the change in the thickness of the endometrium between day 14 and day 21.

15.6 Did fertilisation take place within the 28-day cycle illustrated in the graph?

15.7 Give FOUR reasons for your answer in Question 15.6.

QUESTION 16

Study the following diagram which deals with hormone action in pregnancy in humans and answer the questions that follow.



16.1 Name the two hormones that are secreted by the placenta.

16.2 What is the meaning of *inhibit*?

16.3 Identify:

16.3.1 hormone 1 16.3.2 hormone 2

16.4 What is the function of hormone 1?

16.5 Which hormone also ensures the flow of milk from the breast in response to the sucking reflex of the baby?

16.6 What is the stimulating function of progesterone according to the data provided?

16.7 Why is it important for progesterone to inhibit the secretion of hormone 1?

QUESTION 17

Study the representations of the developing stages of the zygote below and answer the questions that follow.