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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2023

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

Time: 3 hours

200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 44 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper in the spaces provided and hand it in at the end of the examination. Remember to write your examination number in the space above.**
4. Use the total marks that can be awarded and the space provided for each question as an indication of the detail required.
5. It is in your own interest to write legibly and to present your work neatly.
6. TWO blank pages (pages 43 and 44) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

	Q1	Q2	Q3	Q4	Total
Mark					
Marker Initial					
Moderated Mark					
Moderator Initial					
Question Total	**80**	**40**	**40**	**40**	**200**
Re-mark					
Initial					
Code					

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QUESTION 1

1.1 Select the term in Column B that best matches the description in Column A. Write the letter of the term in the space provided between the brackets. Each letter may be used only once.

	COLUMN A		COLUMN B
[ ]	An embryonic plant and its food reserve enclosed in a protective coat.	A	Anther
[ ]	The structure in a flower that produces pollen.	B	Pollination
[ ]	The collective name for all the male reproductive parts of the plant.	C	Filament
[ ]	An asexual reproductive process for growing many of the same type of plant.	D	Ovule
[ ]	The structure in a flower that develops into the seed of a flowering plant.	E	Fertilisation
[ ]	The structure down which the pollen tube grows to reach the ovary of the flower.	F	Stigma
[ ]	The term for the fusion of a male gamete with a female gamete.	G	Style
[ ]	A natural genetic condition where a plant has more than two sets of chromosomes that may result in larger fruit.	H	Tissue culture
[ ]	The female part of the flower that produces a sticky substance for the adherence of pollen grains.	I	Seed
[ ]	The thin stalk that supports the pollen-producing part of the flower.	J	Stamen
		K	Polyploidy

(10)

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1.2 Seven multiple-choice questions follow. Choose the most correct option for each question and write the letter of your choice in the space provided in the table below.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.7
Answer							

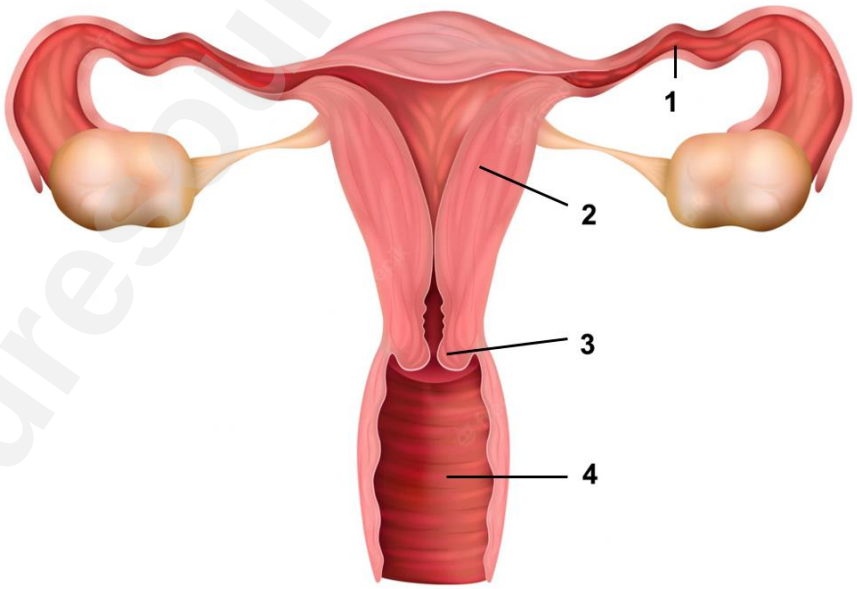
1.2.1 What is the function of the clitoris?

A To enhance sexual pleasure.
B To produce lubricating fluids.
C To secrete hormones.
D To decrease blood flow.

(1)

1.2.2 *Human Papilloma Virus* (HPV) is a common sexually transmitted infection. HPV can cause warts on the vagina and cancer of the cervix.

Figure 1 – Female reproductive system



[Adapted: <https://img.freepik.com>]

Which numbered parts on Figure 1 will be affected by HPV?

A 1 and 4
B 1 and 3
C 2 and 3
D 3 and 4

(1)

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1.2.3 Use the information in the text box below to answer the following question.

Among sexually active females, the total number of individuals in the population who are infected with HPV is the highest in those 20 to 24 years old (± 50 %).

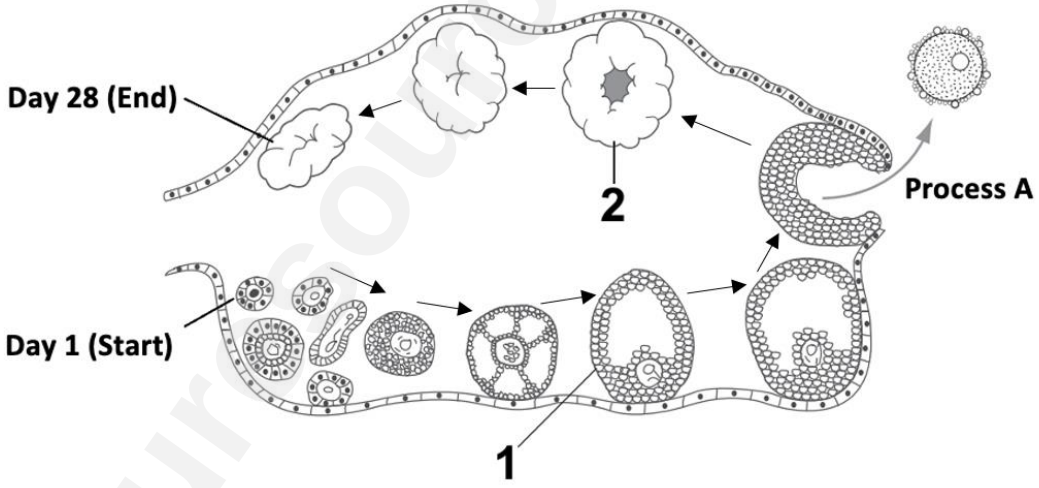
[Source: <https://www.cdc.gov>]

Which option would be the best advice to give to females 20–24 years old to lower the risk of becoming infected with HPV?

A To have an IUD inserted.
B To test regularly for HPV.
C To take oral contraceptive pills.
D To use condoms during sexual intercourse. (1)

Questions 1.2.4 and 1.2.5 are based on Figure 2 below that shows the structures that develop in an ovary during a typical 28-day menstrual cycle, from the start (day 1) until the end (day 28).

Figure 2 – Diagram of an ovary



[Adapted: <www.alberta.ca>]

1.2.4 What event in the ovary does Process A represent?

A Meiosis
B Fertilisation
C Ovulation
D Implantation (1)

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1.2.5 Which row is correct regarding Structure 2 in Figure 2?

	Name of Structure 2	**Hormone secreted by Structure 2**
A	Graafian follicle	Progesterone
B	Graafian follicle	FSH
C	Corpus luteum	Progesterone
D	Corpus luteum	FSH

(2)

1.2.6 Consider the numbered events listed below that occur in the menstrual cycle of a healthy woman.

1 Ovulation occurs.
2 FSH is secreted.
3 LH reaches its highest level.
4 Progesterone secretion increases.

Which option below shows the correct sequence of the numbered events that occur in a healthy menstrual cycle?

A 2 → 1 → 3 → 4

B 2 → 3 → 1 → 4

C 4 → 1 → 3 → 2

D 4 → 2 → 3 → 1 (2)

1.2.7 Which of the secondary sexual characteristics listed below are all true for females during puberty?

(i) Widening of the hips.
(ii) Pronounced deepening of the voice.
(iii) Development of breasts.
(iv) Growth in underarm and pubic hair.
(v) Increased fat distribution.

A (i), (iii), (iv) and (v)
B (i), (ii), (iii) and (iv)
C (i), (iii) and (v)
D (i), (ii), (iii), (iv) and (v) (2)

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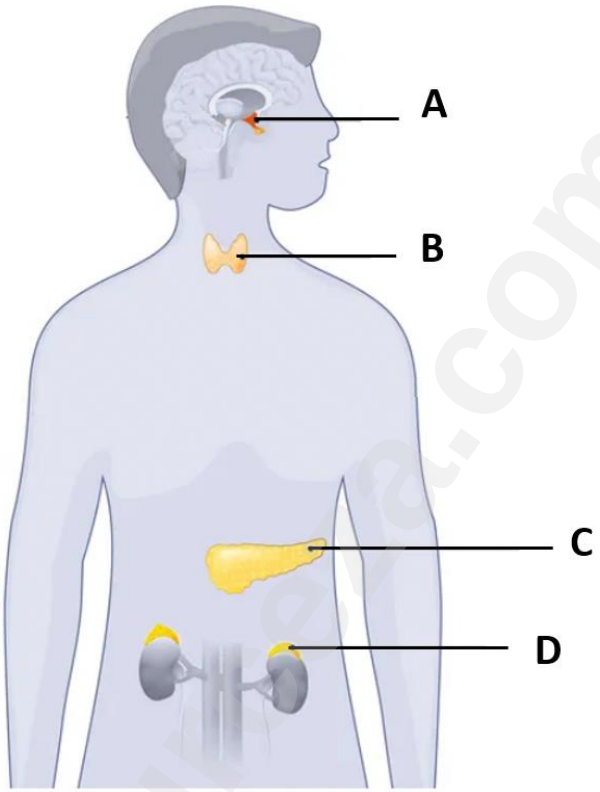
1.3 Figure 3 below shows some of the endocrine glands in the human body.

Figure 3 – Endocrine glands in the human body



[Adapted: <https://www.vectorstock.com>]

1.3.1 Fill in the table below by writing the correct letter (from Figure 3) of the endocrine gland next to the hormone that it secretes.

Hormone secreted	**Letter of endocrine gland**
Adrenalin	
Thyroxin	
Prolactin	

(3)

1.3.2 An oversecretion of a certain hormone in childhood causes gigantism.

Name the hormone and give the letter (from Figure 3) of the endocrine gland that secretes this hormone.

Hormone: _____

Letter of endocrine gland: _____

(2)

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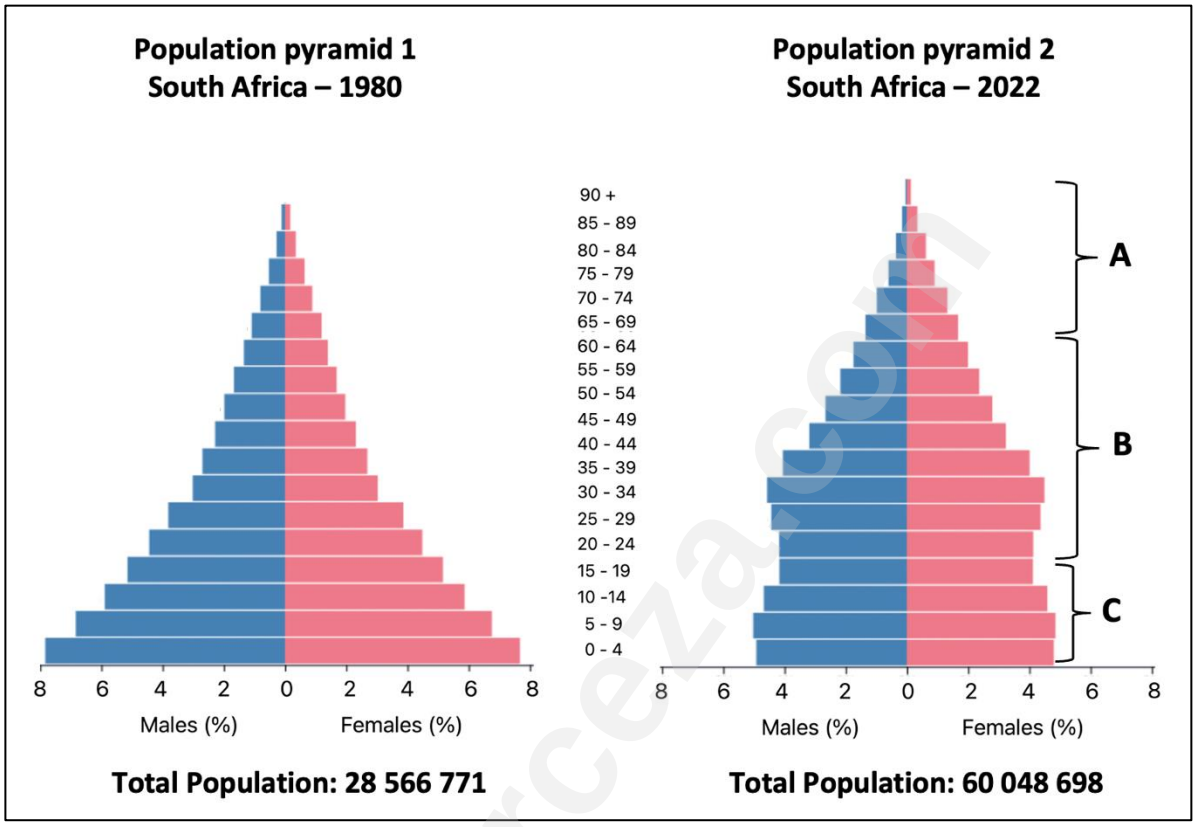
1.4 Study the two population pyramids below that represent the South African population in 1980 and in 2022 and answer the questions that follow.



[Adapted: <https://www.populationpyramid.net>]

1.4.1 Compare the population pyramids of South Africa in the images above. What can you conclude about the following changes that have occurred over the years from 1980 to 2022?

(a) The change in life expectancy.

_____

_____ (1)

(b) The change in birth rate.

_____

_____ (1)

1.4.2 Suggest a reason for the change in the birth rate.

_____

_____ (1)

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1.4.3 Which age group, A, B or C in population pyramid 2, provides economic support for the citizens of the other age groups?

_____

(1)

1.4.4 Calculate the increase in the South African population from 1980 until 2022. Show all working.

_____

_____

_____

_____

(2)

1.5 Study the following table that consists of rows with TWO items (numbered 1 and 2) in the first column and a term in the second column. Decide which item(s) relate to the term. Write down your choice in the space provided in the Answer column, using the following codes:

1 Only item 1 relates to the term.
2 Only item 2 relates to the term.
Both Both items 1 and 2 relate to the term.
None Neither item 1 nor item 2 relates to the term.

Item	**Term**	**Answer**
1. Determined by genes located on autosomes. 2. Determined by genes located on gonosomes.	Sex-linked trait	
1. An mRNA molecule. 2. A random change in DNA sequence.	Allele	
1. An organism's observable characteristics. 2. The genetic make-up of an individual.	Phenotype	
1. Two variations of a gene present in a genotype. 2. The expression of the recessive gene will not be evident.	Heterozygous	
1. A technique used to make more copies of DNA molecules in a sample. 2. A micrograph of all the chromosomes in a cell.	CRISPR	

(5)

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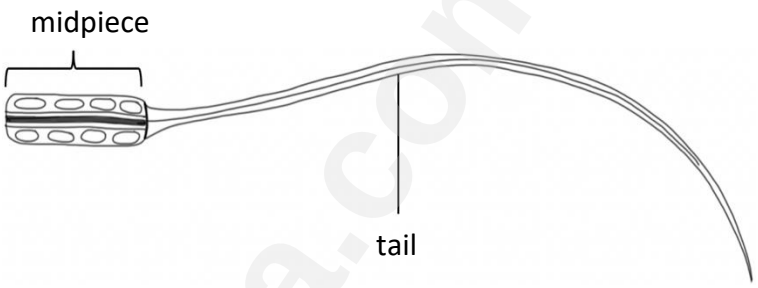
1.6 Read the information below and study Figure 4. Use this information and your own knowledge to answer the questions that follow.

A healthy, mature human sperm cell has a distinct structure. It has a tail that is eight times longer than the oval-shaped head. It also has a midpiece that is slightly longer than the head.

Figure 4 – A portion of a healthy, mature human sperm cell



[Adapted: <https://onlinelibrary.wiley.com>]
[Image: Examiner's own]

1.6.1 On Figure 4 above, complete the diagram by drawing in and labelling the following structures:

(a) The head to show the correct proportions to represent a healthy, mature sperm cell. (2)

(b) The nucleus. (1)

(c) The acrosome. (1)

1.6.2 Will the nucleus in this cell contain a haploid or a diploid set of chromosomes?

_____ (1)

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1.7 Scientists investigated the relationship between the length of the midpiece of sperm cells and the speed at which sperm can swim.

Table 1 below shows the data from the investigation.

Table 1 – The relationship between the length of the midpiece of sperm cells and swimming speed

Length of mid piece (µm)	Swimming speed (µm/second)
1,5	46
2,5	55
4,5	80
6	95

[Adapted: <https://www.researchgate.net>]

1.7.1 Give the name of the structure in the male reproductive system where sperm is stored and matures.

_____

(1)

1.7.2 Give a reason why sperm cells with a larger midpiece are more successful at fertilising an ovum.

_____

_____

_____

(2)

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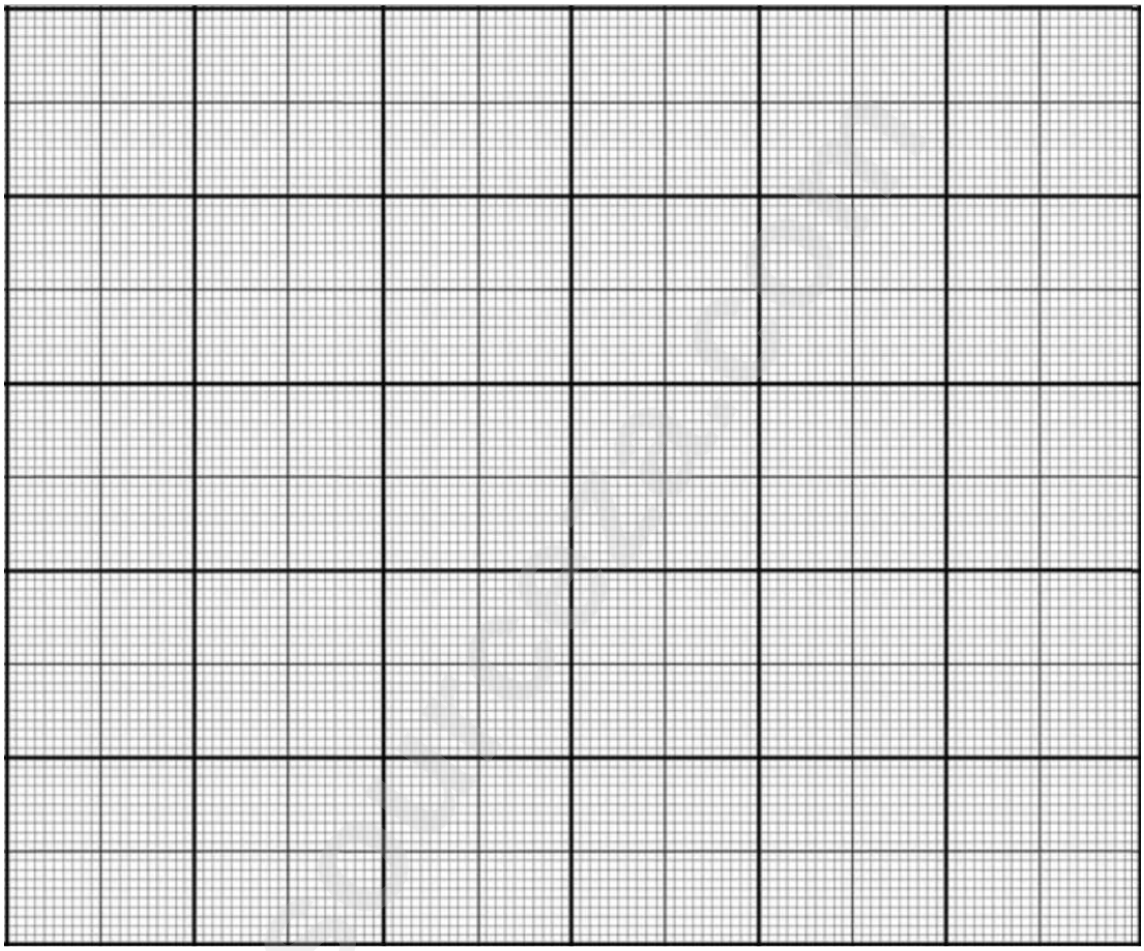
1.7.3 Plot a line graph of the data in Table 1 on the graph paper below.



(7)

1.7.4 Write a conclusion for the investigation.

_____

_____

_____

(2)

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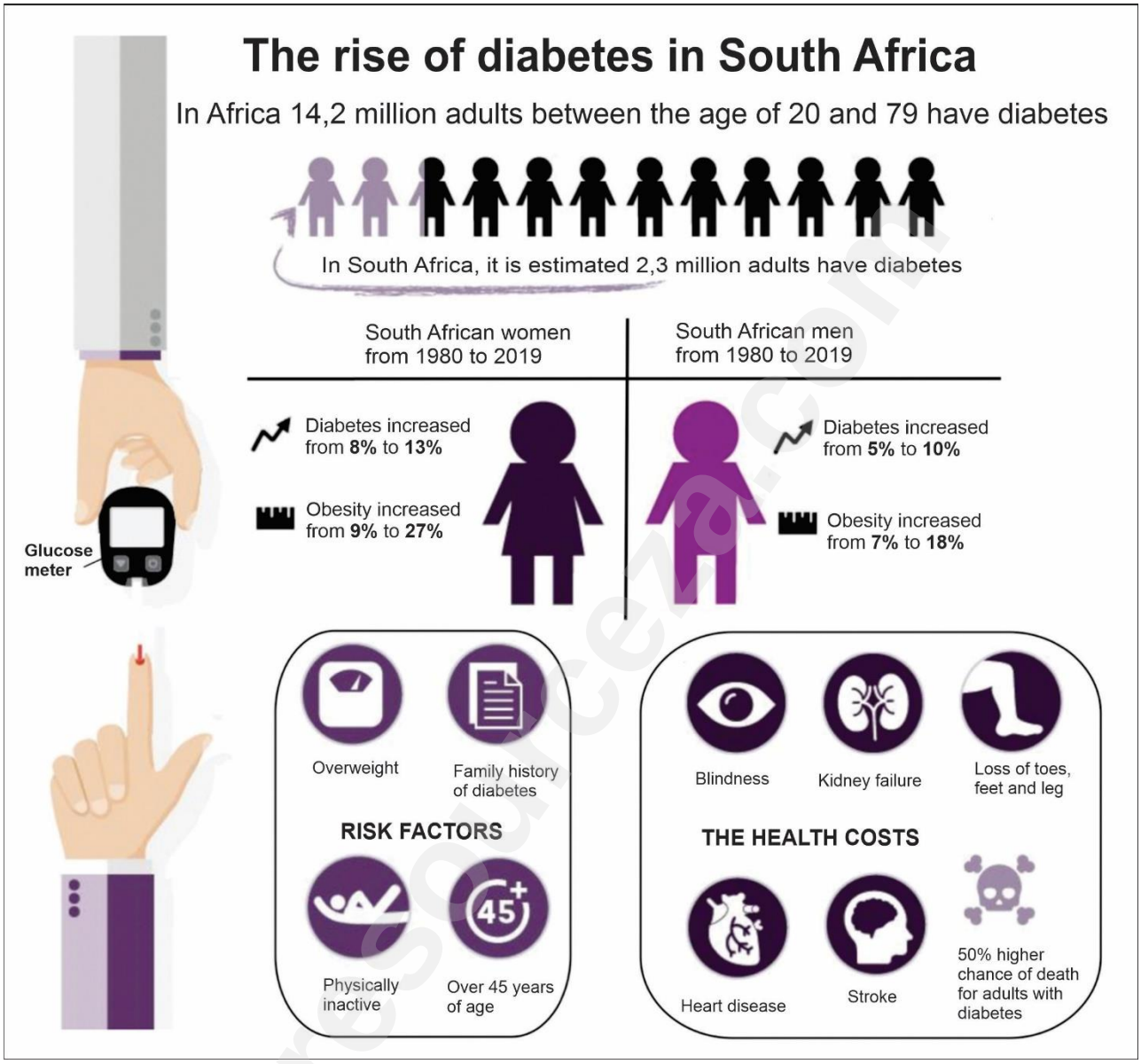
1.8 Study the infographic below and answer the questions that follow.



[Adapted: <https://thepharmaworld.co.za/diabetes>]

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1.8.1 The statements in the table below refer to the information on page 12. For each statement decide whether:

A The statement is supported by the information.
B The statement is contradicted by the information.
C The statement is neither supported nor contradicted by the information.

	Statement	**A, B or C**
(a)	A blood sample can be taken from a finger to test glucose levels.	
(b)	Obesity has increased in both men and women in South Africa since 1980.	
(c)	There are 14,2 million South African adults with diabetes.	
(d)	The risk of diabetes decreases over the age of 45 years.	
(e)	Diabetes is the leading cause of death in South Africa.	

(5)

1.8.2 Diabetes is characterised by high blood glucose levels. The hormone insulin is responsible for lowering the blood glucose levels in the body.

Describe TWO ways in which insulin functions to lower blood glucose levels.

(4)

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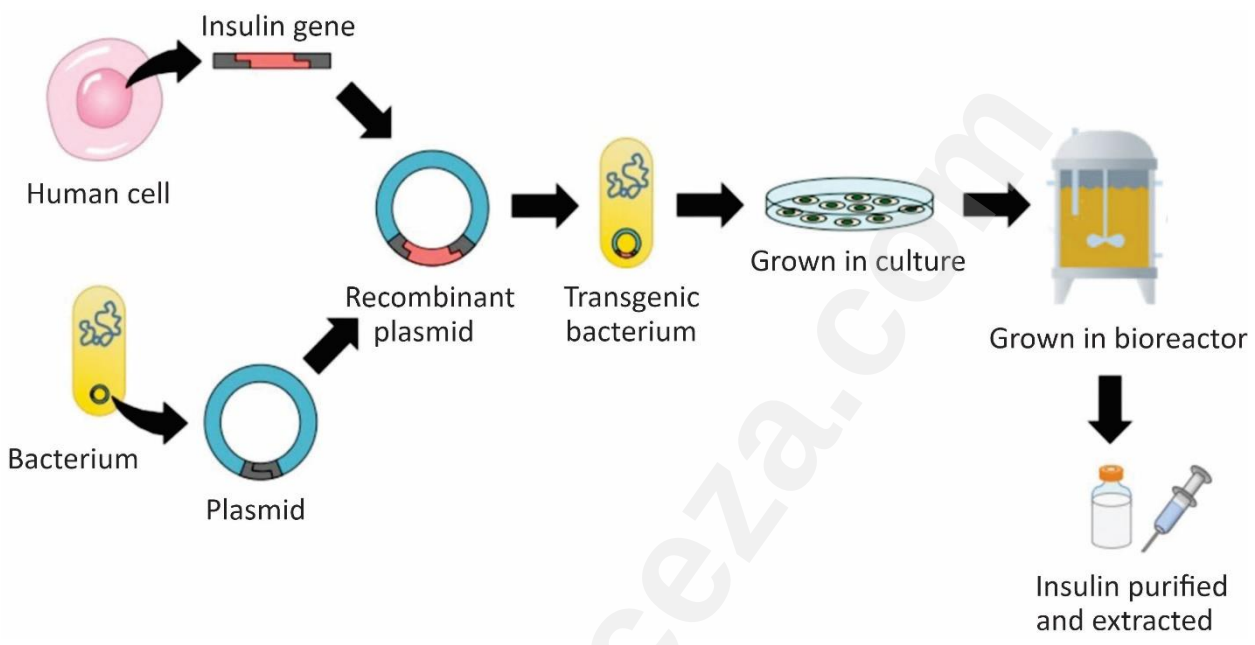
1.9 Human insulin can be made using recombinant DNA technology. Figure 5 below outlines the process.

Figure 5 – Production of insulin using recombinant DNA technology



[Adapted: <https://ib.bioninja.com.au>]

1.9.1 What is meant by the term *transgenic bacterium* in the example above?

_____

_____

_____

(2)

1.9.2 State the role of the following enzymes in the process shown in Figure 5.

(a) Restriction enzyme

_____

(1)

(b) Ligase enzyme

_____

(1)

1.9.3 On Figure 5, place an **X** at the point in the production process where the DNA ligase would function.

(1)

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1.9.4 Experiments in the production of transgenic organisms could be unsuccessful as the organisms could produce the incorrect proteins.

Explain ONE reason why it is important that scientists report the results of any failed experiments.

(2)

1.9.5 Explain an advantage of producing insulin using recombinant DNA technology.

(2)

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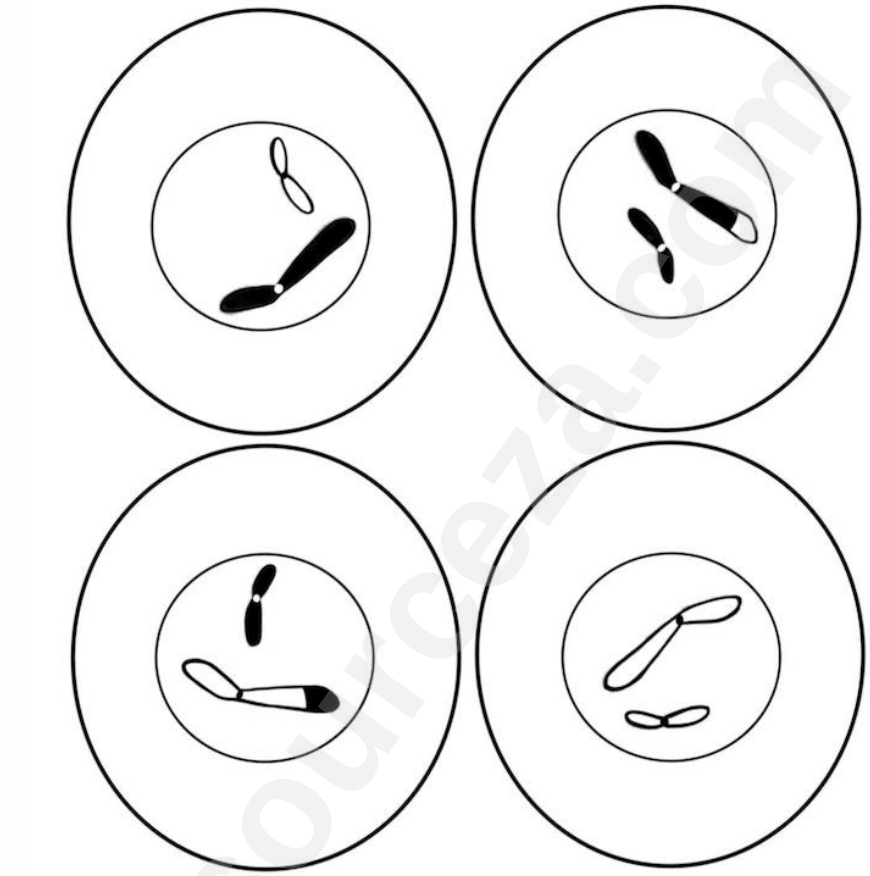
1.10 Figure 6 below depicts the four cells that are produced at the end of telophase II of meiosis in a cell. Refer to these diagrams and your own knowledge to answer the questions that follow.

Figure 6 – Cells produced at the end of telophase II of meiosis



[Source: Examiner's own]

1.10.1 Give ONE piece of evidence that is visible in the cells that shows that meiosis has taken place.

_____

_____

_____

_____

(1)

1.10.2 Label a centromere on any cell in Figure 6. (1)

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1.10.3 Explain ONE reason why meiosis is important in sexual reproduction.

_____

_____

_____

_____

_____

(2)

1.10.4 In the space provided below, draw a diagram to represent the parent cell at the end of prophase I that gave rise to the four cells seen in Figure 6.

- The chromosome number must be correct and the chromosomes must be clearly visible in the diagram.
- No heading is required.

(5)
[80]

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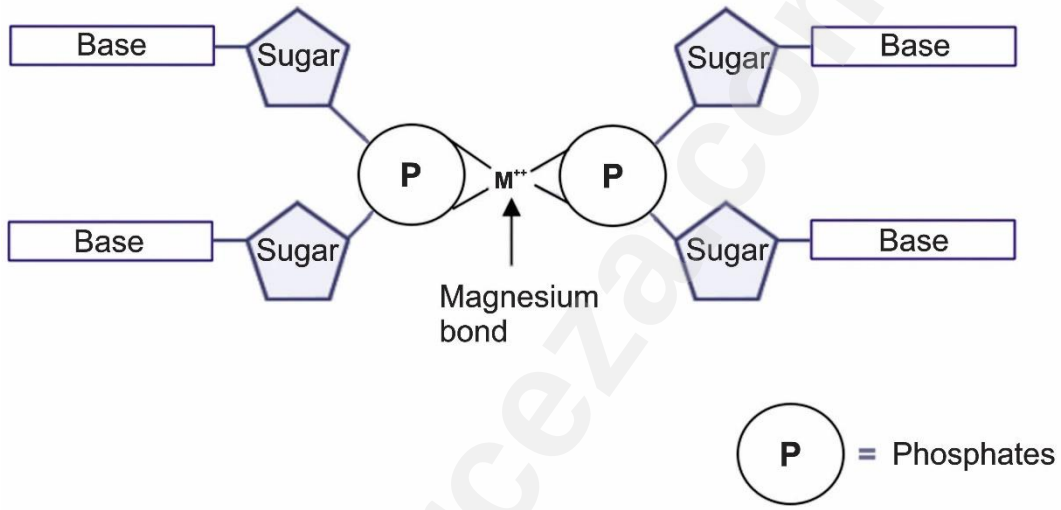
QUESTION 2

2.1 Read the information below and answer the questions that follow.

The first model that Watson and Crick designed to show the structure of DNA was incorrect as seen in Figure 7 below.

Figure 7 – Watson and Crick's incorrect model of DNA structure



However, with the help of Maurice Wilkins (Rosalind Franklin's colleague), they obtained data from Rosalind Franklin's X-ray crystallography photos without her awareness. This data allowed them to work out the details and make corrections to their model.

Watson and Crick published their results in the scientific journal *Nature* in 1953; the same issue of the magazine carried Franklin's X-ray crystallography photos. Watson, Crick, and Wilkins received the Nobel Prize in 1962, after Franklin's death.

[Adapted: <https://apcentral.collegeboard.org>]
[Image adapted from: <https://undsci.berkeley.edu>]

2.1.1 Give the term for the single unit of a nucleic acid that consists of a sugar molecule, a base and a phosphate molecule.

_____ (1)

2.1.2 There are four nitrogenous bases in DNA. Provide the name of the base that is complementary to:

(a) Thymine: _____ (1)

(b) Guanine: _____ (1)

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2.1.3 Compare TWO ways in which Watson and Crick's incorrect model in Figure 7 differs from the accepted model of the structure of DNA.

(4)

2.1.4 Do you consider the use of Franklin's crystallography photos by Watson and Crick to be ethical? Explain your answer.

(2)

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2.1.5 Construct a flow diagram to show the process of DNA replication.

(6)

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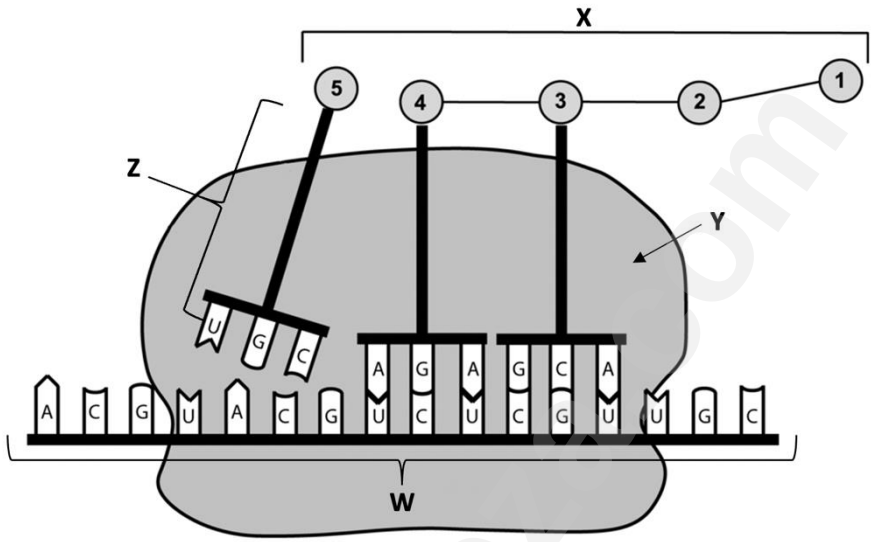
2.2 Study Figure 8 below that shows a stage in protein synthesis and use it to answer the questions that follow.

Figure 8 – Stage in protein synthesis



[Adapted: <https://commons.wikimedia.org>]

2.2.1 Name the stage of protein synthesis shown in Figure 8.

_____ (1)

2.2.2 Give the letter that represents:

(a) A section of the protein molecule being constructed _____ (1)

(b) mRNA _____ (1)

2.2.3 What is the role of tRNA in protein synthesis?

_____

_____ (2)

2.2.4 Name the bond that forms between parts numbered 4 and 5.

_____ (1)

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2.2.5 The table below lists some amino acids and their corresponding codons.

mRNA codon	Amino acid
UGC	Cys
ACG	Thr
AGA	Arg
UCU	Ser
UAC	Tyr
GCA	Ala
CGU	Arg

Use the information in the table to work out which amino acids are coded for by numbers 3, 4 and 5 in Figure 8 on page 21.

3: _____

4: _____

5: _____

(3)

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2.3 Read the information in the textbox below and answer the questions that follow.

> The Human Genome Project was a large, well-organised and collaborative effort by scientists from all over the world to sequence the human genome. Every part of the human genome data that was obtained by the scientists was made available to the public and other scientists soon after it was analysed.

[Adapted: <https://www.genome.gov>]

2.3.1 State ONE way in which the Human Genome Project has had a positive impact on society.

_____

_____

_____

(1)

2.3.2 Suggest why it is beneficial that the human genome data was released shortly after it was analysed.

_____

_____

_____

_____

(2)

2.4 Read the following information on Leigh syndrome.

> Leigh syndrome is a severe neurological disorder that usually presents in the first year of life of the sufferer. This condition is characterised by increasing loss of mental ability and movement ability. It typically results in death in childhood.
>
> Leigh syndrome can be caused by mutations in one of more than 75 different genes. The loci of these genes can be in the nuclear DNA or the mitochondrial DNA.
>
> Leigh syndrome can have different inheritance patterns. It is most commonly inherited in an <u>autosomal recessive pattern</u>.

[Adapted: <https://medlineplus.gov>]

2.4.1 What is a *mutation*?

_____

_____

_____

(1)

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2.4.2 Which option listed below is the most correct description of the term *loci*? Circle the letter of your choice below.

A Two or more versions of a DNA sequence for a gene.
B The position or place of a gene on a chromosome.
C Multiple genes that influence the expression of a characteristic.

(1)

2.4.3 Why are traits coded for by mtDNA not passed on to children by their fathers?

_____

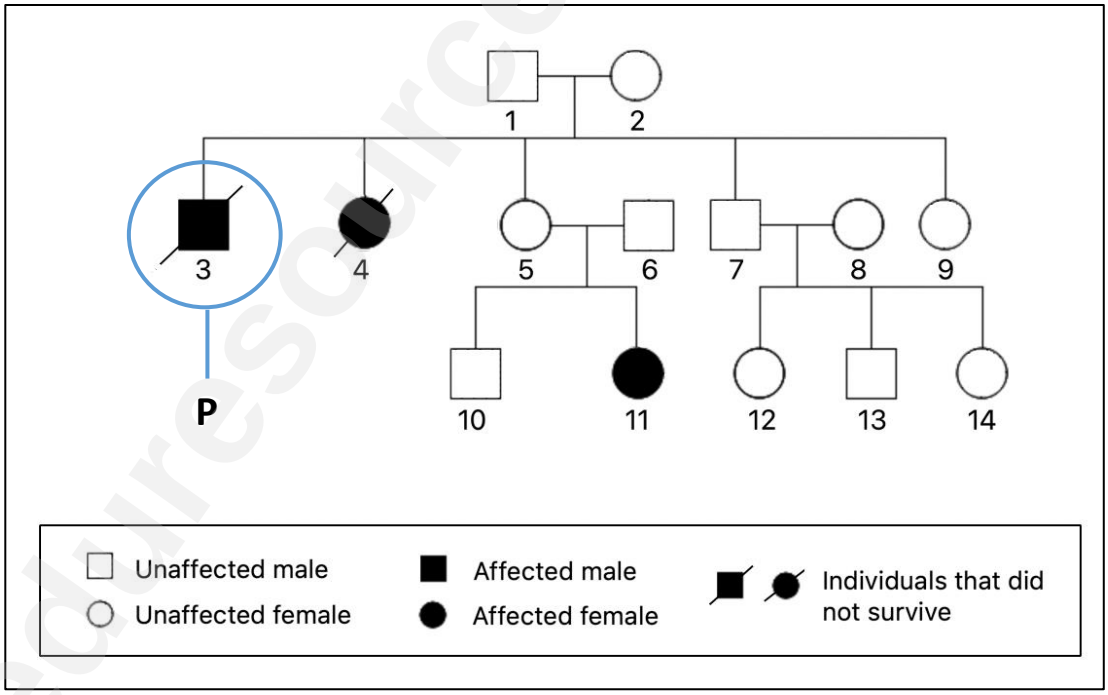
_____

_____

_____

(2)

2.4.4 The pedigree chart below shows the autosomal recessive inheritance of a mutation causing Leigh syndrome in a family.



[Adapted: <https://www.nature.com>]

(a) List THREE facts that can be determined from the symbol for individual 3 in the circle labelled **P**.

_____

_____

_____

(3)

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(b) By means of a genetic diagram, show how individuals 1 and 2 passed on Leigh syndrome to some of their children.

Include the following in your answer:
- Parental genotypes.
- A genetic cross or Punnett diagram.
- The probable genotypic and phenotypic ratios of the offspring.

Use the following key in your answer:
- **B** – unaffected
- **b** – mutation causing Leigh syndrome

(6)
[40]

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QUESTION 3

3.1 Read the information in the textbox below on abalone and answer the questions that follow.

Abalone *(Perlemoen)*

South African abalone, also known as perlemoen, are endemic marine snails.

They live in the shallow waters and intertidal zones on the South African coastline, from Port St Johns in the Eastern Cape to Saldanha Bay in the Western Cape. They cling to the rocks and the immature abalone like to hide in the cracks between rocks.

Figure 9 – Abalone mollusc

It is an economically important species and wild populations have drastically decreased due to poaching. Abalone is a delicacy that is sought-after in Asian countries such as China.

Table 2 – Facts about Abalone Reproduction

Reproduction	Spawning – eggs and sperm are released into the water.
Number of eggs released by abalone	• Immature abalone with a shell length of 2,5 cm release around 10 000 eggs. • Mature abalone with a shell length of 20 cm release over 10 million eggs.
Time taken for fertilised eggs to hatch into larvae	1 day after fertilisation
Mortality in larvae	Very high – possibly exceeding 98%
Time taken to reach sexual maturity in wild abalone	7 years
Survival rate	Very low: fewer than 1 in 10 000 reach maturity.

[Adapted: <https://www.sanbi.org> ; <http://www.fishtech.com>]
[Image: <https://www.collinsdictionary.com/images/full/abalone_325843490.jpg>]

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3.1.1 Which option below is TRUE regarding the reproductive strategies of abalone? Write only the correct letter in the box.

A	External fertilisation	Viviparous
B	Internal fertilisation	Ovoviviparous
C	External fertilisation	Oviparous

(2)

3.1.2 Explain how the ability to produce between 10 000 to 10 million eggs improves the reproductive success of abalone.

(2)

3.1.3 (a) Are abalone an example of an *r*-strategist or a *k*-strategist species? Provide two supporting facts from the data given in Table 2 on page 26.

(3)

(b) Sketch a simple graph of a survivorship curve for abalone.
(No heading required.)

(3)

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3.1.4 Poachers target the larger-sized abalone with a shell length of 20 cm because they are more profitable.

Explain the impact that this activity will have on abalone populations in the future.

(3)

3.2 Read the following text.

DNA barcodes used to discourage poachers and wildlife traffickers

The **Barcode of Wildlife Project** (BWP) is creating a DNA reference library of the world's most-threatened species.

The library allows for the accurate identification of threatened plant and animal species. It can be used by government agencies for border inspections and in courtroom prosecutions. It aims to develop DNA barcodes for every species.

With its rich biodiversity, South Africa has become a favourite destination for poachers and wildlife traffickers. BWP have selected 130 threatened species including endangered plants, pangolins, vultures, abalone and protected fish species. DNA samples have been taken from these threatened species for the reference library.

[Adapted: <https://www.pub.ac.za>]

3.2.1 Provide TWO ways in which data from the Barcode of Wildlife Project can be used.

(2)

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3.2.2 Suggest a reason why it may be difficult to obtain DNA samples from abalone.

(2)

3.2.3 Abalone were confiscated from poachers in South Africa and the DNA was analysed. The DNA profiles below show three abalone species that are recorded in the Barcode of Wildlife library and the unknown sample that was confiscated.

Unknown specimen	Species A	Species B	Species C

[Source: Examiner's own]

(a) To which species does the unknown specimen most likely belong? Give a reason for your answer.

(2)

(b) Why is non-coding DNA used in DNA profiling?

(1)

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(c) Describe ONE measure that the South African authorities can put in place to reduce abalone poaching.

_____

_____

_____

_____

(2)

3.3 Read the following information on abalone farming.

> To meet the global demand for abalone, the establishment of abalone farms and breeding programmes has increased.
>
> A research team developed a selective-breeding programme that resulted in a hybrid between two varieties of the same blacklip abalone species *(Haliotis rubra).* One variety produces good-quality and a large amount of meat. The second variety has a fast growth rate. The hybrid produced from the breeding of these two varieties shows all these characteristics.
>
> Key criteria that were met in this breeding programme to create the hybrids were:
>
> 1. To establish a closed population.
> 2. To ensure that individuals that were used for breeding were genetically diverse.
> 3. That all breeding individuals in the population were healthy.

[Adapted: <https://www.globalseafood.org>]

3.3.1 Explain the meaning of the term *hybrid*.

_____

_____

_____

_____

(2)

3.3.2 State two phenotypic traits that were selected for in the breeding programme.

_____

_____

(2)

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3.3.3 Justify why each criterion listed in the breeding programme is scientifically important.

Criterion 1:

Criterion 2:

Criterion 3:

(6)

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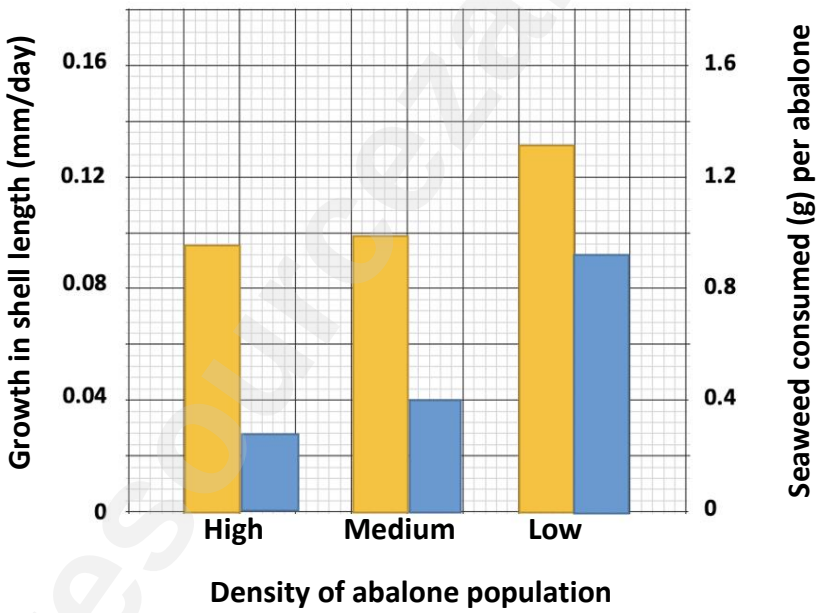
3.4 Read the information on abalone farming and answer the questions that follow.

In abalone farming the abalone are grown in water tanks known as hatcheries. The water is kept at a temperature of 18 °C to allow for spawning and it is filtered to remove wastes. The abalone are fed a diet of seaweed.

An abalone farm investigated the effect of abalone population density on the growth of abalone in the hatcheries. The following method was used:

- Abalone were placed in three separate tanks at different abalone densities: high, medium and low.
- The growth in shell length and the mass of seaweed consumed were measured.
- The results are shown in Figure 10 below.

Figure 10 – Graph showing the effect of population density on abalone growth



Key:

Seaweed consumed

Shell growth

[Adapted: <https://www.sciencedirect.com>]

3.4.1 Identify the following in the investigation:

(a) The independent variable.

_____ (1)

(b) One controlled variable.

_____ (1)

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3.4.2 What was the growth in shell length when the abalone were placed in medium-density water tanks?

_____

(2)

3.4.3 Refer to your understanding of density-dependent factors to explain the differences in the growth of shell length at the following densities:

(a) High density.

_____

_____

_____

_____

(2)

(b) Low density.

_____

_____

_____

_____

(2)

[40]

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QUESTION 4

4.1 Read the information below and answer the questions that follow.

The Killer Whale *(Orcinus orca)*

The **killer whale** is a toothed dolphin and is the largest member of the dolphin family. Because of its size it may be referred to as a whale.

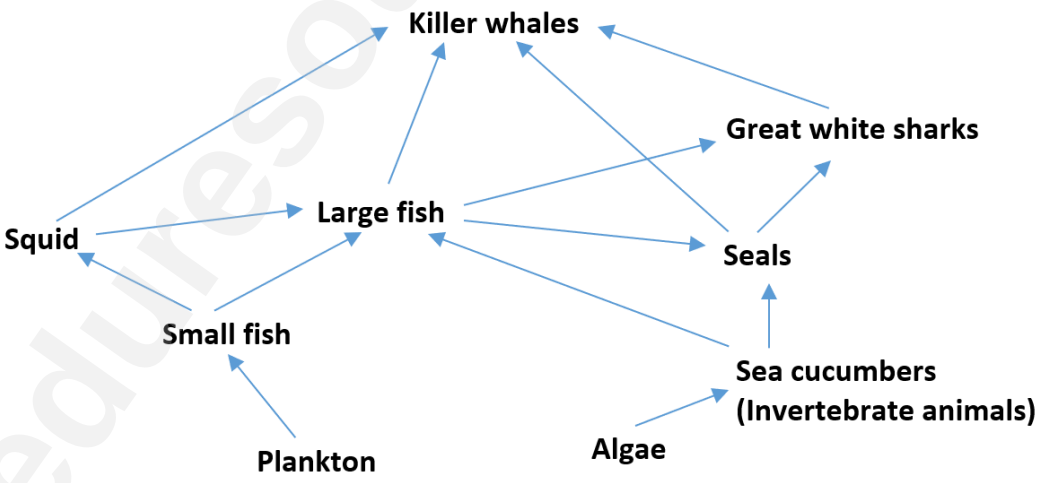
- They have a black-and-white patterned body (see Figure 11).
- They are found in all of the world's oceans: from the cold polar regions to tropical seas.

Figure 11 – Killer whale jumping out of the water

[Image: <www.whaletrail.co.za>]

Killer whales have a diverse diet – some feed only on fish and squid, while others hunt marine mammals such as seals. Some have been known to feed off larger animals such as great white sharks and other species of dolphin. Killer whales are apex predators – these are predators that are at the top of the food chain.

Figure 12 – Food web



[Source: Examiner's own]

Their social structures are complex, and most are organised in stable matriarchal family groups (females are dominant in their society). The groups or 'pods' can include 2 to 15 individuals. Larger groups of up to 100 individuals have been seen, but experts say this is a temporary grouping. Their sophisticated hunting techniques and vocal behaviours, which are often specific to a particular group and passed across generations, have been described as evidence of animal culture.

[Adapted: <www.wikipedia.org> and <www.killer-whale.org>]

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4.1.1 What is meant by the term *predator*?

(2)

4.1.2 Refer to Figure 12.

(a) Draw a food chain from the food web that consists of five organisms. (Diagrams of organisms not required).

(3)

(b) Explain why ecosystems may not have many food chains with four or more trophic levels.

(2)

4.1.3 Explain TWO ways in which the social organisation of killer whale pods improves their chances of survival.

(4)

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4.1.4 State TWO similarities between the social structure of killer whales and wild dogs.

(2)

4.2 Read the information in the textbox below and use it and your own knowledge to answer the questions that follow.

Most of our knowledge about gestation and foetal development in killer whales has been obtained from pregnant killer whales that were stranded on beaches. From these stranded killer whales biologists know: • Killer whales are mammals with a placenta where the foetus and mother are connected via an umbilical cord. • The umbilical cord contains two arteries and two veins.

4.2.1 Give TWO functions of the placenta in mammals.

(2)

4.2.2 Clearly describe the position of the umbilical cord in mammals.

(2)

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4.3 Read the information below and on page 38 and use it and your own knowledge to answer the questions that follow.

The *Shark Spotters* organisation is a shark safety strategy that is used on South African beaches, from the False Bay coastline in Cape Town to beaches in the Eastern Cape.

It was established in 2004 in response to the increased number of shark bite incidents and shark sightings at popular beaches. From various locations near the shore *Shark Spotters'* employees use binoculars to scan the ocean looking for dark shadows moving through the sea and identify them as sharks based on their size, shape and movement patterns. In addition to recording the number of sightings of various species of sharks, they also warn swimmers of the presence of sharks in the waters.

A Shark Spotter employee scanning the ocean with binoculars

[Image: <https://surfemporium.co.za/wp-content/uploads/2018/04/shark.jpg]

In 2015, *Shark Spotters* recorded a pair of killer whales seen in the False Bay area. Experts say these killer whales are specialised in hunting great white sharks.

A killer whale **A great white shark**

[Source: <https://people.com/pets/two-orcas-in-south-africa-hunting-great-white-sharks>]

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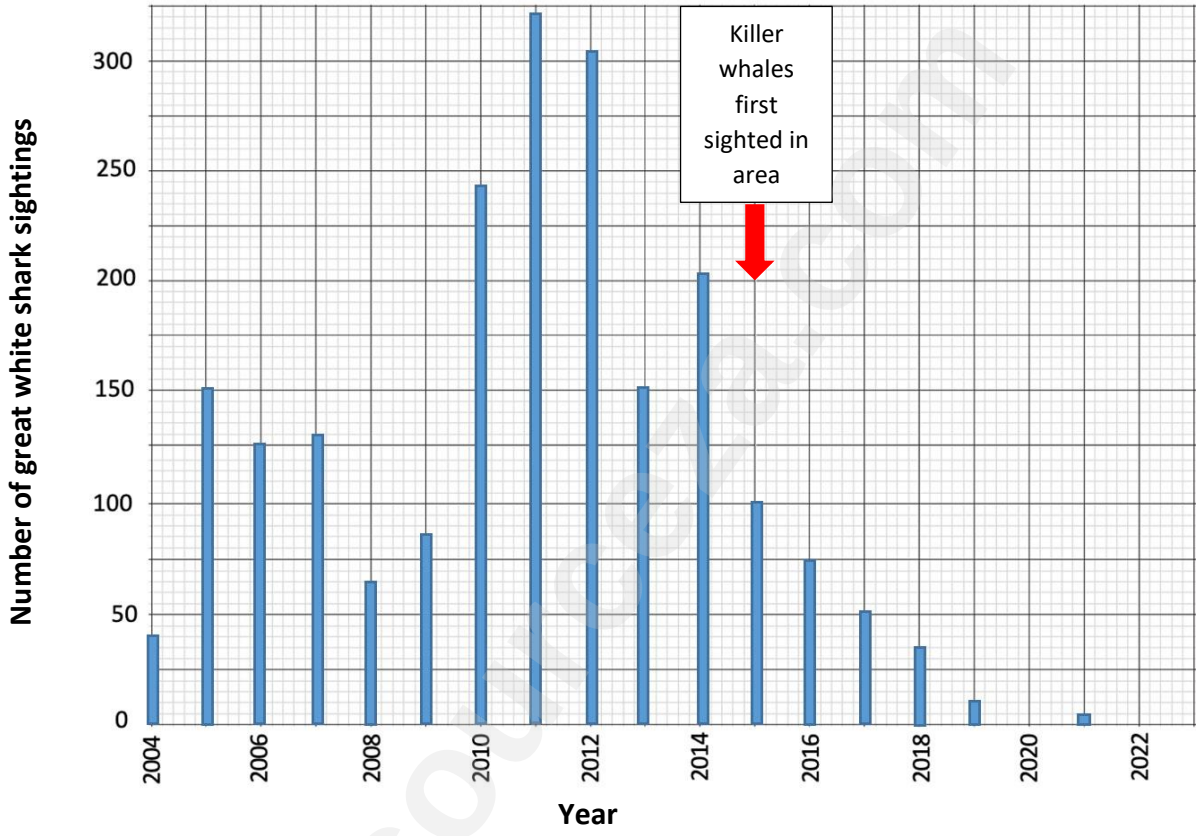
Figure 13 below shows the number of great white shark sightings along the False Bay coastline since 2004.

Figure 13 – Graph showing the number of great white sharks sighted in False Bay area since 2004



[Adapted: <https://sharkspotters.org.za/safety/shark-sightings>]

4.3.1 From the graph, what effect did the presence of the killer whales in the False Bay area have on the sightings of great white sharks?

_____

_____

(1)

4.3.2 State the type of competition that exists between killer whales and great white sharks. Give a reason for your answer.

_____

_____

_____

(2)

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4.3.3 Why are 'the number of sightings' of great white sharks by *Shark Spotters* not a reliable sampling method of the actual great white shark population of False Bay?

(3)

4.3.4 Provide TWO reasons why the work of the *Shark Spotters* organisation is of value.

(2)

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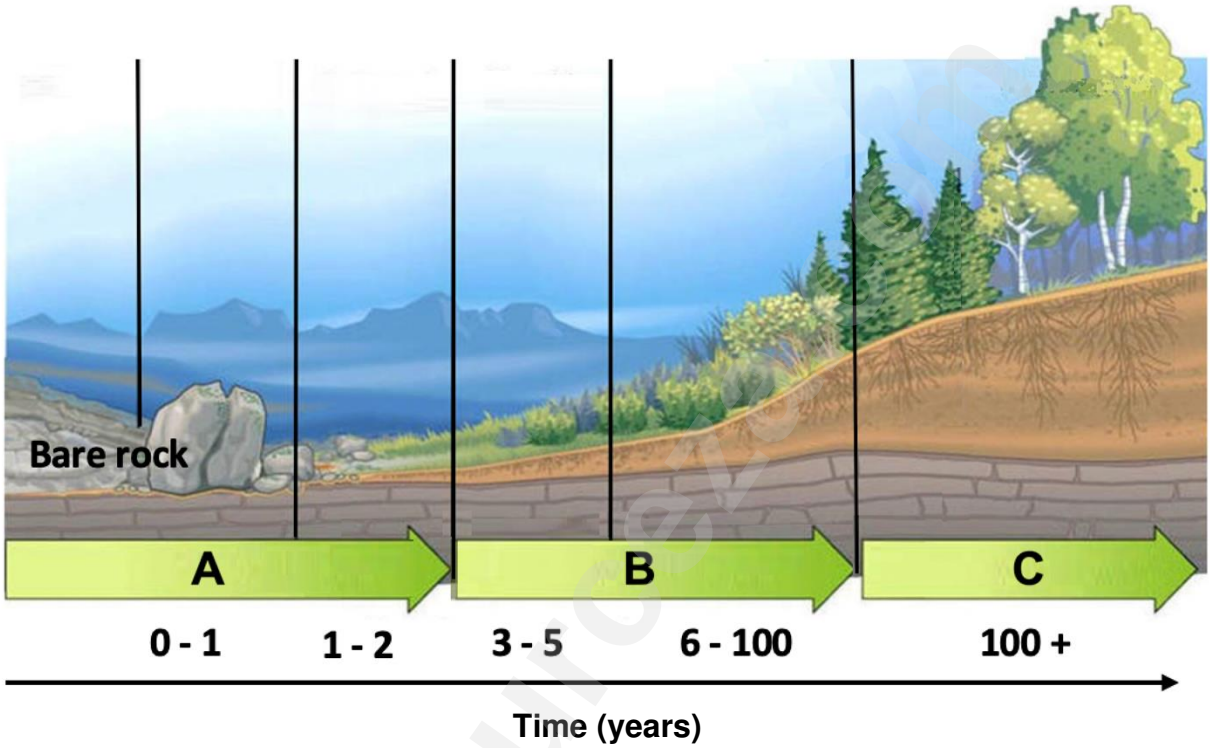
4.4 Figure 14 below shows an example of ecological succession in a nature reserve.

Figure 14 – Ecological succession showing community change over time in a nature reserve

Note: Time axis is not to scale.



[Adapted: <http://loretocollegebiology.weebly.com>]

4.4.1 Is Figure 14 an example of primary or secondary succession? Give a reason for your answer.

_____

_____

(2)

4.4.2 The table below shows a numbered list of items.

1	All organisms are of the same species.
2	Organisms are of many different species.
3	Includes only the abiotic factors.
4	Organisms live in different biomes.
5	Organisms live in the same area.

(a) Select, from the numbered list in the table, the TWO most correct items that apply to the biological term '*community*'.

Write only the numbers as your answer. _____

(2)

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(b) Provide the letter (A, B or C) from Figure 14 that represents the following communities:

(i) Climax community: _____ (1)

(ii) Pioneer community: _____ (1)

(c) Construct a table to compare any TWO differences between climax and pioneer communities.

(4)

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4.5 A biologist used the mark–recapture method to estimate the population size of a species of field mice in a nature reserve. In her first capture, she tagged/marked 34 field mice and released them. Two weeks later, she captured 52 field mice and recorded that 13 were tagged/marked.

4.5.1 Calculate the estimated population size of field mice in the nature reserve. Show all working.

(3)

4.5.2 Give TWO precautions that the biologist must take to improve the accuracy of the mark–recapture method.

(2)
[40]

Total: 200 marks

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ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.

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