

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

ANSWER BOOKLET

There are (xv) pages in the Answer Booklet. Please write your examination number in the blocks above.

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 only be used once.

COLUMN A

COLUMN B

- | | |
|--|-------------------|
| [] Causes contraction of the uterine muscle during birth | A ADH |
| [] Secreted by the adrenal gland during times of stress | B Thyroid |
| [] The disorder caused by an over-secretion of growth hormone | C Homeostasis |
| [] A hormone that stimulates the reabsorption of water in the kidney to reduce the water content of urine | D Prolactin |
| [] Gland located below the larynx | E Goitre |
| [] Releases TSH when thyroxin levels decrease | F Adrenalin |
| [] Process of maintaining a stable internal environment | G Glucose |
| [] An event that is triggered by high levels of LH | H Pituitary gland |
| [] Stimulates the production of milk in the mammary glands | I Gigantism |
| [] A condition caused by a lack of iodine in the diet | J Dwarfism |
| | K Oxytocin |
| | L Ovulation |

(10)

1.2 Seven multiple-choice questions are asked below. Choose the most correct answer to each question and write the letter of your choice 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							

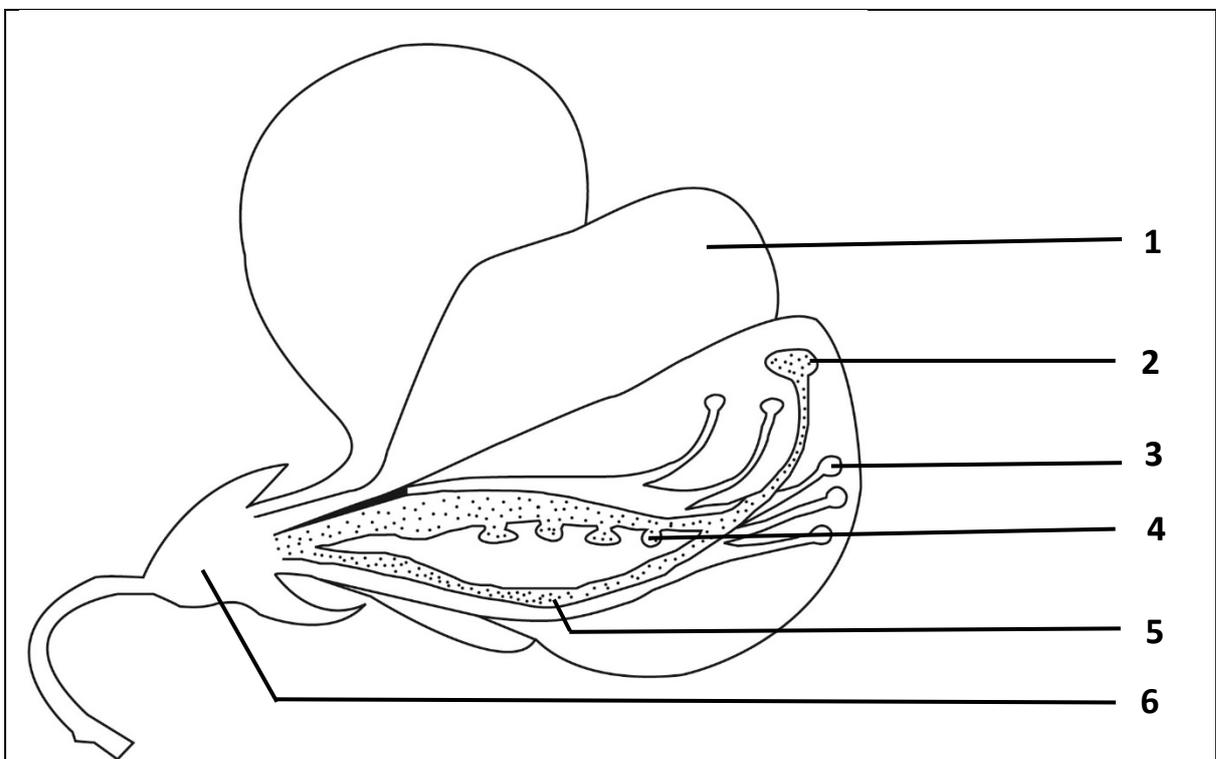
1.2.1 Which of the following descriptions are true of sexual reproduction in organisms?

- (i) produces clones of the parent
- (ii) allows for evolution to take place
- (iii) always involves internal fertilization
- (iv) a slower rate of reproduction
- (v) involves the process of meiosis

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

(2)

Use the diagram of a longitudinal section through a pea flower below to answer questions 1.2.2 and 1.2.3.



[Adapted from: <<http://www.uq.edu.au>>]

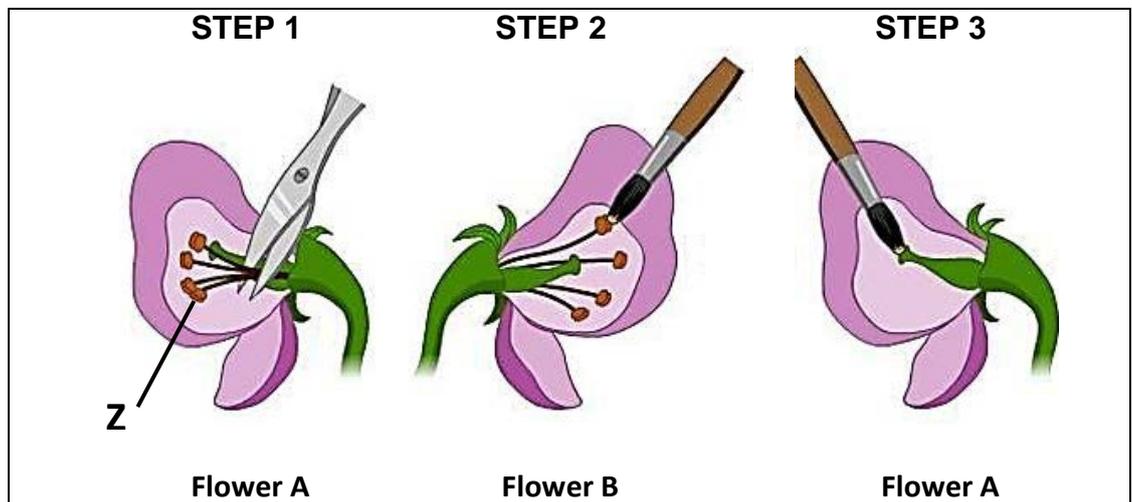
1.2.2 Identify the number/s (from the diagram) of structure/s that contain the gametes.

- A 3 and 4
 - B 2 and 3
 - C 4 and 5
 - D 2 only
- (1)

1.2.3 Identify the number from the diagram that indicates the structure that develops into the seed.

- A 3
 - B 4
 - C 6
 - D 2
- (1)

1.2.4 The following diagram illustrates a method used by Mendel when investigating inheritance in pea plants.



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

The purpose of removing the structures labelled Z from flower A was to:

- A prevent self-pollination in flower A.
 - B allow self-pollination in flower A.
 - C prevent meiosis from occurring in flower A.
 - D prevent fertilization from occurring in flower A.
- (1)

1.2.5 The data collected by Mendel when crossing pea plants can be regarded as reliable because:

- A he only collected his data from the F₁ generation.
 - B he had a thorough knowledge of genes and chromosomes.
 - C he did not start his experiment with pure breeding plants.
 - D he obtained results from collecting data from 21 000 plants.
- (1)

1.2.6 Which statement is a correct deduction that can be made from Mendel's work on pea plants?

- A A blend of parents' traits will be seen in their offspring.
- B Polygenic inheritance results from more than two alleles.
- C Genes come in pairs and are inherited as distinct units.
- D The laws of inheritance are applicable only to plants. (1)

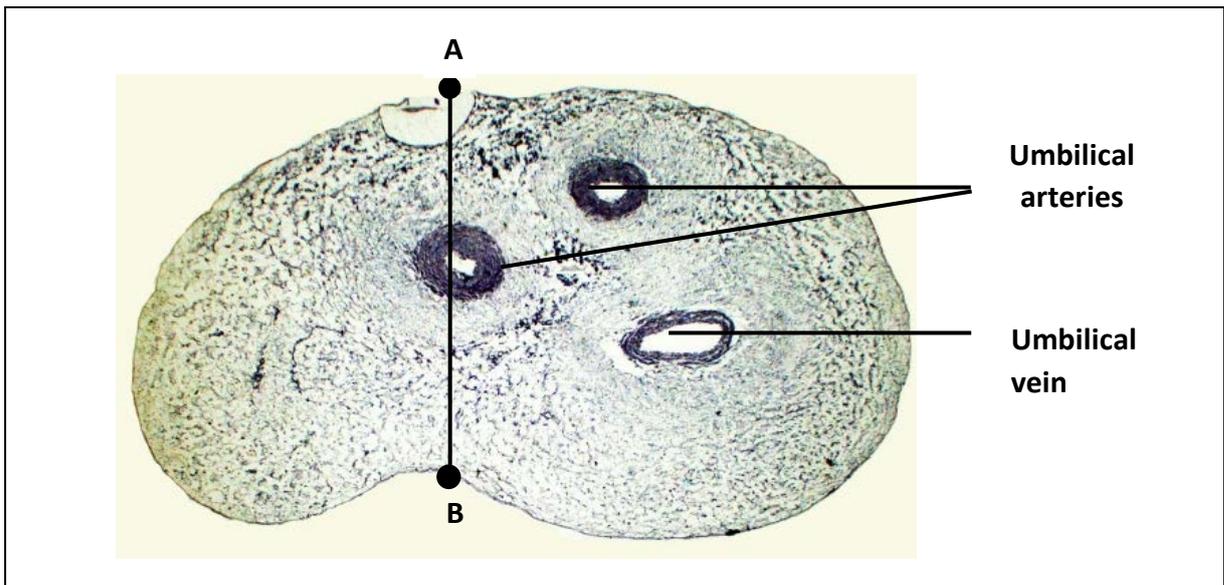
1.2.7 In pea plant flowers, the colour purple is dominant over the colour white. When Mendel crossed two purple-flowered pea plants, he obtained the following ratio of plants in the offspring:

705 purple flowers : 224 white flowers.

The genotypes of the parents are:

- A homozygous dominant and heterozygous
- B both heterozygous
- C homozygous recessive and heterozygous
- D homozygous recessive and homozygous dominant (2)

1.3 The micrograph below shows a section through an umbilical cord of a 14-week-old human foetus.



[Adapted from: <<https://embryology.med.unsw.edu.au>>]

1.3.1 Is this micrograph showing a cross/transverse section or a longitudinal section of the umbilical cord?

_____ (1)

1.3.2 State TWO functions of the blood vessels in the umbilical cord.

(2)

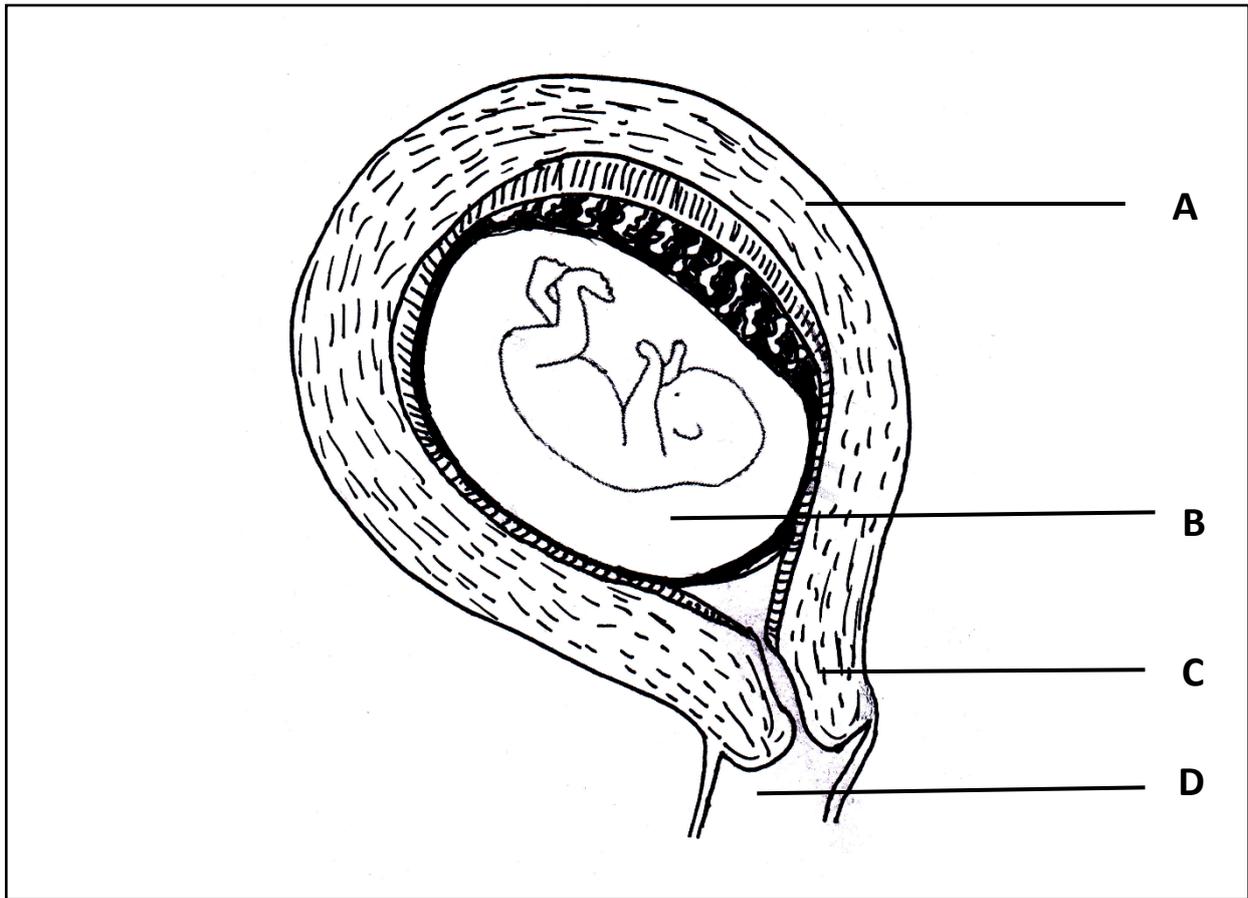
1.3.3 Suggest a reason why some parents choose to store the blood from their baby's umbilical cord.

(2)

1.3.4 The actual length from A to B is 5 mm. Calculate the magnification of the micrograph. Show your working.

(3)

1.4 The diagram below shows a developing human foetus.



[Adapted: <<https://waeconline.org.ng>>]

1.4.1 Provide labels for A to D.

A: _____

B: _____

C: _____

D: _____

(4)

1.4.2 Draw the umbilical cord on the diagram to show its correct position.

(2)

1.4.3 State the biological importance of B.

(2)

1.5 DNA is often referred to as the "molecule of life".

1.5.1 Explain why this statement can be regarded as correct.

(2)

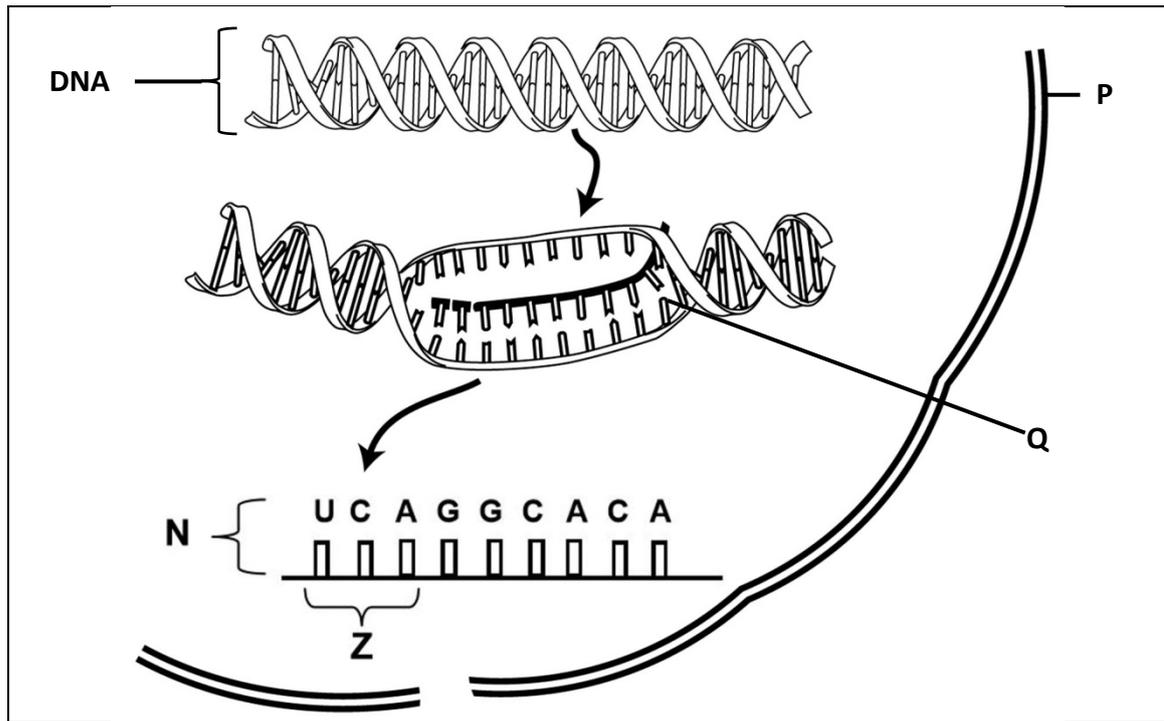
1.5.2 Draw and label the basic structure of a DNA nucleotide in the space below.

(4)

1.5.3 In a section of a DNA molecule there are 16 nucleotides. There are three adenine nitrogen bases in the section of DNA. Calculate the number of guanine nitrogen bases present. Show all working.

(3)

1.6 The diagram below shows part of the process of protein synthesis.



[Adapted: <<https://za.pinterest.com>>]

1.6.1 Provide labels for the following structures:

N: _____

Z: _____

P: _____

(3)

1.6.2 Name the process occurring at **Q**.

_____ (1)

1.6.3 Name the enzyme that catalyses the process occurring at **Q**.

_____ (1)

1.6.4 Molecule **N** shown in the diagram codes for the following sequence of amino acids:

Ser – Gly – Thr

- (a) Where does the process of joining amino acids into a polypeptide chain occur in the cell?

(1)

- (b) Identify the bond that holds the adjacent amino acids together.

(1)

- (c) If **Z** on the diagram on the previous page codes for **Ser**, write down the nucleotide sequence that codes for **Gly**.

(1)

- (d) A **point mutation** occurred during the formation of molecule **N**. Molecule **N** now codes for the following sequence of amino acids:

Ser – Val – Thr

If **GUC** codes for **Val**, identify the type of mutation and explain exactly what change in the DNA occurred that led to the mutation.

(2)

1.7 Read the text below and use the information provided to complete the table on the next page.

Using eDNA to identify shark species

Humans shed tens of thousands of skin cells every hour, leaving them everywhere they go. Contained in each of these cells is an individual's entire set of DNA. Sharks are no different and scientists have begun to collect bottles of water from the ocean to find cells as clues of a species' presence in an area. This is called "environmental DNA", or "eDNA".

The cells or genetic material from sharks can come from:

- natural shedding of skin
- tissue separated from the body by injury
- cells released into the water during reproduction
- decomposition of dead sharks

Environmental DNA complements rather than replaces other sampling methods in the identification of shark species.

Two of the sampling methods used by scientists to identify different shark species are: environmental DNA (eDNA) from sea water, and observations from human divers studying sharks.

The results of their sampling in a particular area is shown in the table below.

Table showing the results of shark identification using two different sampling methods

Shark name	eDNA	Diver
Bull shark	✓	
Great hammerhead	✓	
Copper shark	✓	
Silvertip shark	✓	
Sharptooth lemon shark	✓	✓
Zebra shark	✓	✓
Tawny nurse shark		✓
Scalloped hammerhead		✓
Tiger shark		

[Adapted: <<https://fishbio.com>> and <<https://www.sciencenews.org>>]

The six statements in the table below refer to the information on the previous page. For each statement, decide whether:

- A** the statement is supported by the information in the article.
- B** the statement is contradicted by the information in the article.
- C** the statement is neither supported nor contradicted by the information in the article.

	Statement	A, B or C
1.7.1	eDNA from sharks can be sourced from reproductive cells found in sea water.	
1.7.2	Collection of eDNA from sharks requires direct contact with the shark.	
1.7.3	The zebra shark was identified using only one method of sampling.	
1.7.4	The lack of eDNA from the tiger shark indicates that the shark was never in the area.	
1.7.5	eDNA can replace other methods of identifying sharks.	
1.7.6	According to the results in the table, using eDNA is more effective than using human divers to identify the presence of sharks.	

(6)

1.8 Study the following table which 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.**

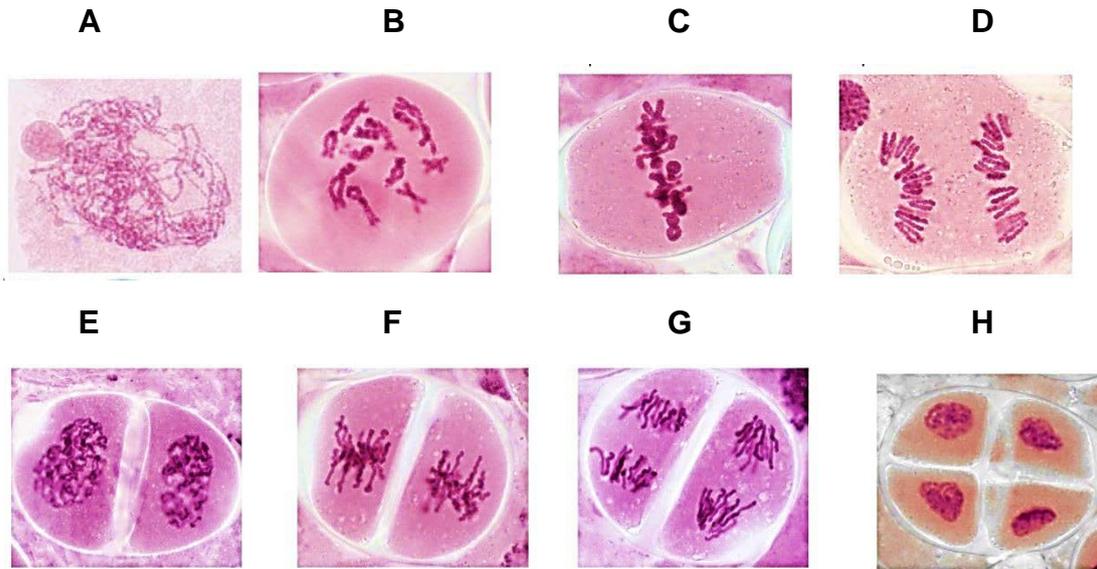
Write down your choice in the space provided in the **Answer** column, making use of the following codes:

- A** only item 1 relates to the term
- B** only item 2 relates to the term
- C** both items 1 and 2 relate to the term
- D** neither item 1 nor item 2 relates to the term

Item	Term	Answer
1. Used as a vector to carry foreign genetic material into another cell 2. Circular DNA strand	Plasmid	
1. Production of insulin in bacterial cells 2. Introduction of normal genes into cells to replace defective genes	Gene therapy	
1. Cell having more than two sets of paired chromosomes 2. Producing exact genetic copies	Cloning	
1. A powerful tool for editing sections of DNA 2. Used only in gamete cells	CRISPR	
1. Determining the genomes in many different species 2. Altering of human genome by transferring genes from another organism	Human Genome Project	

(5)

1.9 The micrographs below depict the phases of meiosis in a cell. The micrographs are in the correct order.



[Adapted: <<http://www.macmillanhighered.com>>]

Select the letter of the diagram that best matches the description in the table below.

Description	Letter of diagram
Crossing over is occurring.	
DNA replication is taking place.	
Chromatids have separated and are moving to opposite poles.	
Haploid gametes are formed.	
Homologous chromosomes separate and move away from one another.	

(5)

1.10 A national park in Kenya covering an area of 2 200 km² was divided into quadrats. Each quadrat has an area of 20 km². Eight quadrats were randomly chosen for observation. Helicopters were used to fly over the quadrats and the numbers of observed elephants were counted.

The numbers of elephants counted in each quadrat is shown below:

Quadrat number	1	2	3	4	5	6	7	8
Number of elephants	4	1	3	2	0	1	3	6

1.10.1 Calculate the estimated size of the elephant population in the national park. Show all working.

(4)

1.10.2 Why was observing and counting the elephants from a helicopter a suitable sampling measure to use?

(1)

1.10.3 Why is it important to take random samples when calculating population sizes?

(2)

1.10.4 Explain the meaning of the following terms with reference to elephants:

(a) viviparous

(1)

(b) K-strategist

(2)

[80]