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MARKS**

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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020
FORMERLY MAY/JUNE

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

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ANSWER BOOKLET

There are (xiv) 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 a description in Column A. Write the letter of the term in the corresponding space provided between the brackets. Each letter may be used only once.

COLUMN A

- [] Discovered the molecular structure of DNA.
- [] Technology used in criminal forensics.
- [] DNA that does not provide instructions for making proteins.
- [] Used to identify chromosomal abnormalities.
- [] A physical or chemical agent that alters genetic material.
- [] Unit of heredity that transmits information from one generation to another.
- [] Makes many copies of a small section of DNA.
- [] Type of sugar molecule found in DNA.
- [] Thread-like structures containing DNA.
- [] Monomer of nucleic acids.

COLUMN B

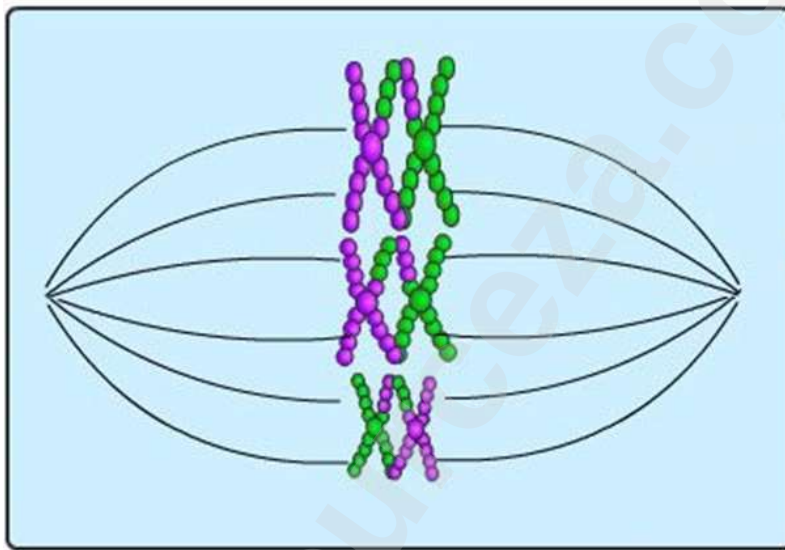
- A Karyotype
- B Mendel
- C Deoxyribose
- D Chromosomes
- E Amino acids
- F Polymerase chain reaction
- G Watson and Crick
- H DNA profiling
- I Gene
- J Noncoding DNA
- K Mutagen
- L Nucleotide

(10)

- 1.2 Six multiple-choice questions are given below. 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
Answer						

- 1.2.1 The phase of meiosis depicted in the diagram below is:



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

- A metaphase 1
- B metaphase 2
- C prophase 1
- D anaphase 2

(1)

- 1.2.2 Crossing over is the process whereby ...

- A homologous chromosomes replicate their genetic material.
- B chromatin material shortens and thickens to form chromosomes.
- C genetic material is exchanged between adjacent chromatids of homologous chromosomes.
- D homologous chromosomes separate and move to opposite poles.

(1)

1.2.3 In which of the following locations will meiosis NOT take place?

- A Ovule of a flower
 - B Mammary gland of a human
 - C Germinal epithelium of human testes
 - D Pollen grains of flower
- (1)

1.2.4 A human zygote contains 7 picograms ($1 \text{ picogram} = 10^{-12} \text{ grams}$) of DNA. Which of the following statements gives the correct amount of DNA in the reproductive cells?

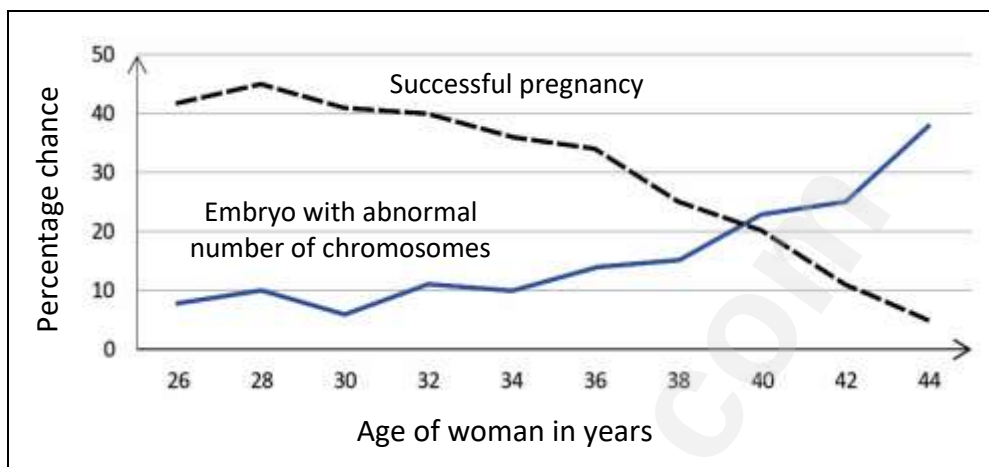
- A A human sperm cell and an ovum will each contain 7 picograms of DNA.
 - B A human embryo cell will contain 14 picograms of DNA.
 - C A human ovum will contain 4 picograms and a sperm cell will contain 3 picograms of DNA.
 - D A human sperm cell and an ovum will each contain 3,5 picograms of DNA.
- (2)

1.2.5 Which of the following statements are true regarding the importance of meiosis?

- (i) Gametes are produced.
- (ii) The number of chromosomes are doubled.
- (iii) It results in genetic variation.
- (iv) Identical haploid cells are produced.
- (v) It ensures that organisms produced by sexual reproduction have the correct number of chromosomes.

- A All statements are correct.
 - B (i), (iii) and (iv) are correct.
 - C (i), (ii) and (v) are correct.
 - D (i), (iii) and (v) are correct.
- (2)

- 1.2.6 The graph below shows the chance of women of different ages having an embryo with an abnormal number of chromosomes, as well as the chances of having a successful pregnancy.



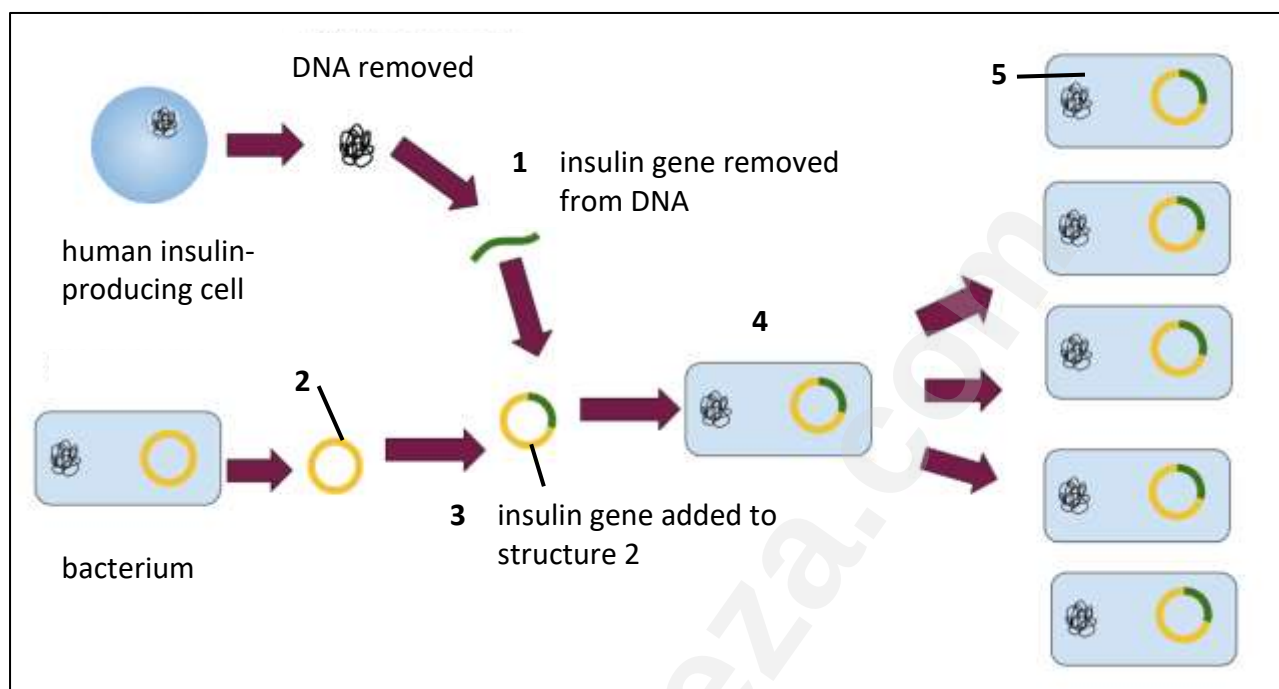
[Adapted: <<https://www.sbivf.com>>]

Which one of the following statements correctly describes the information shown in the graph?

- A Only older women are likely to have embryos with an abnormal number of chromosomes.
- B A decrease in pregnancy rates with maternal age may be caused by a corresponding increase in embryos with an abnormal number of chromosomes.
- C The chances of an embryo with an abnormal number of chromosomes and a successful pregnancy increase with maternal age.
- D There is no relationship between maternal age, an embryo with an abnormal number of chromosomes and a successful pregnancy.

(2)

- 1.3 Study the diagram below showing the process of producing human insulin using recombinant DNA technology.



[Adapted: <<https://newvitruvian.com>>]

- 1.3.1 Select the number (1–5) from the diagram that corresponds to the term/description in the table below. Numbers may be used more than once.

	Term/Description	Correct number
(a)	Ligase enzymes are used.	
(b)	GMO	
(c)	Restriction enzymes are used	
(d)	Plasmid containing only bacterial DNA	

(4)

- 1.3.2 What is meant by *recombinant DNA technology*?

(1)

- 1.3.3 From which organ is the insulin-producing cell taken?

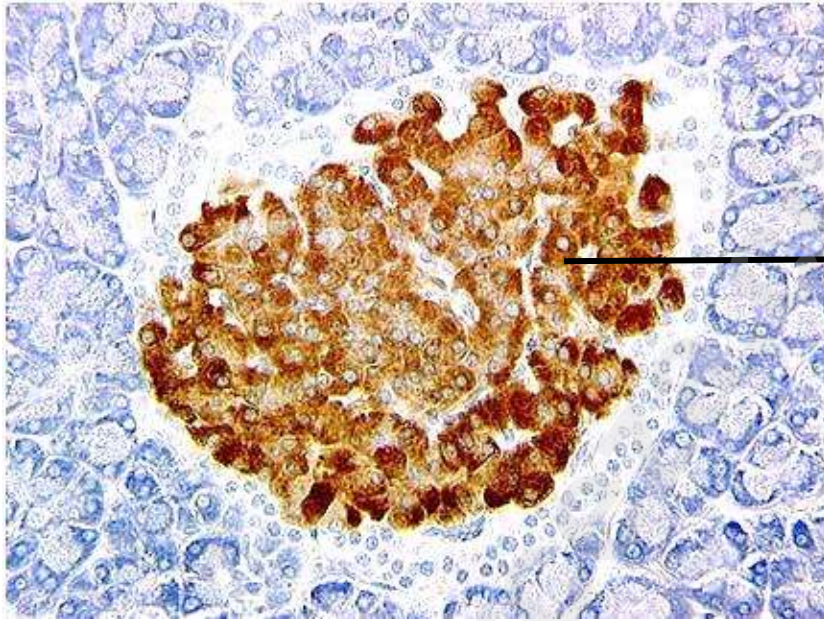
(1)

- 1.3.4 Name the disease that is treated by the human insulin manufactured in this process.

(1)

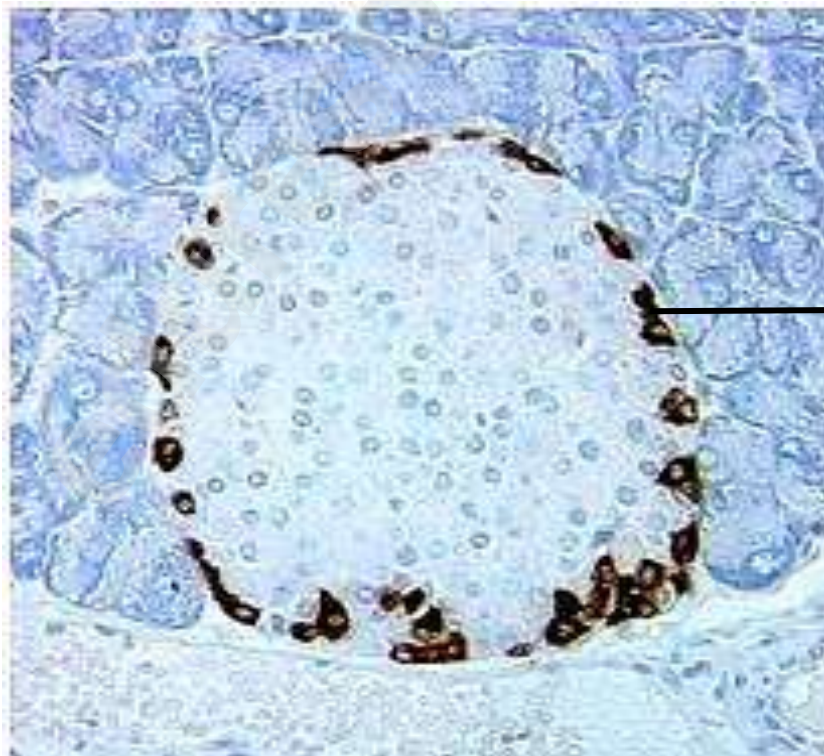
- 1.3.5 The two micrographs below show the endocrine tissue of the islets of Langerhans in a mouse. Image A shows a micrograph where a stain for insulin has been used. Image B shows a micrograph where a stain for glucagon has been used.

Image A



**Beta cells that
secrete insulin**

Image B



**Alpha cells
that secrete
glucagon**

[Source: <<https://www.pancreapedia.org>>]

- (a) What is an endocrine gland?

(2)

- (b) Use the information given in the micrographs and your own knowledge to complete the table below.

	Cells secreting insulin	Cells secreting glucagon
Name of cells in islets of Langerhans that secrete the hormone		
Position of cells in islets of Langerhans		
Fewer/more cells		
Glucose levels in blood that stimulate release of the hormone		

(8)

- (c) Explain why there are also blood vessels located in the endocrine tissue.

(2)

- 1.4 Study the following table on the endocrine system that consists of 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

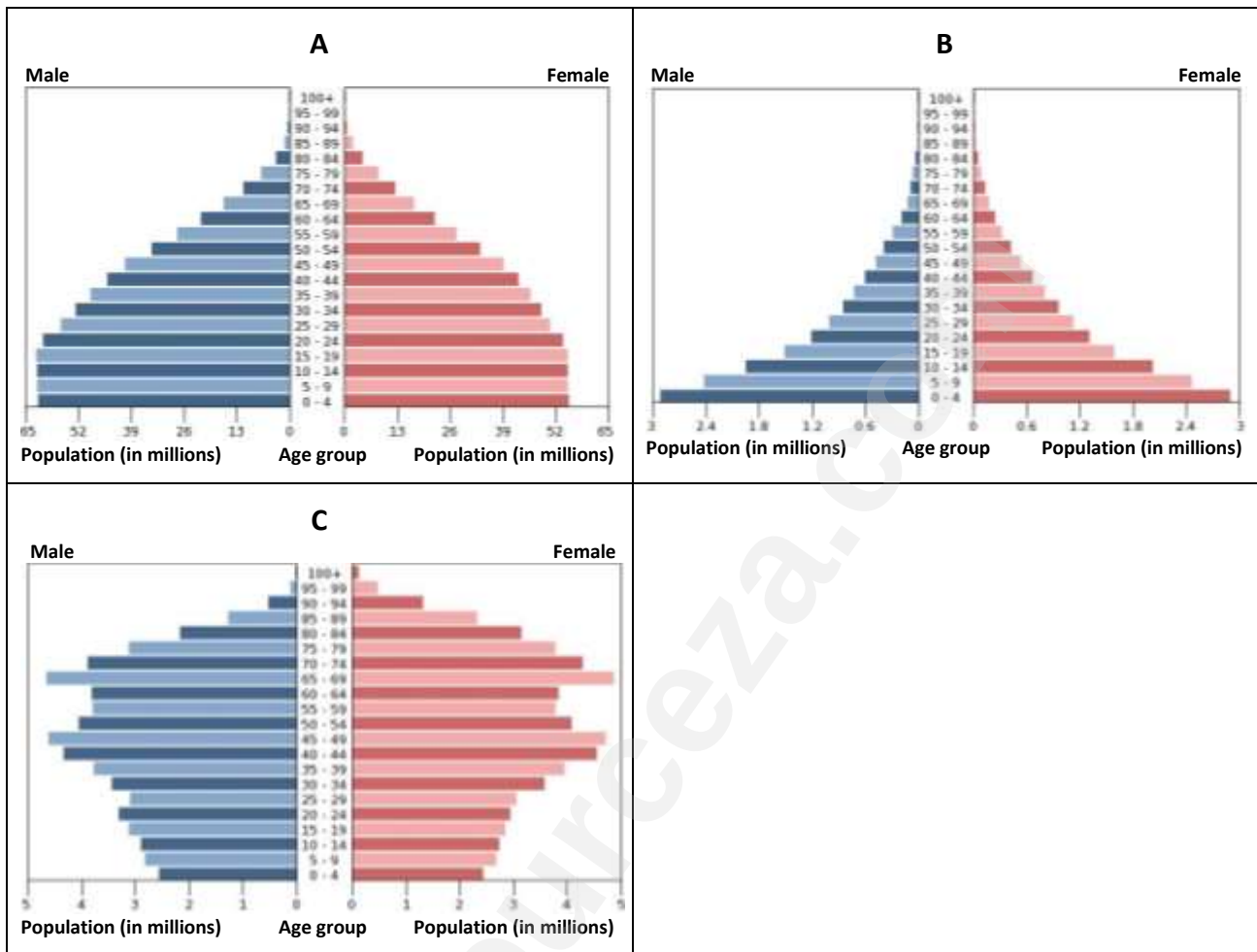
C: both item 1 and item 2 relate to the term

D: neither item 1 nor item 2 relates to the term

Item	Term	Answer
1. Hormone secreted from the ovaries 2. Controls release of FSH through negative feedback	Progesterone	
1. Stimulates ovulation 2. Secreted by the corpus luteum	Prolactin	
1. Over-secretion of growth hormone 2. Common in children	Acromegaly	
1. Target organ is the bladder 2. Controls the water content and the overall volume of blood	Anti-diuretic hormone / ADH	
1. Maintenance of a constant internal environment 2. Endocrine and nervous system	Homeostasis	

(5)

1.5 The graphs below show age–sex pyramids of various countries in 2018.



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

Select the letter of the graph (A, B or C) that best matches the description in the table below. Letters may be used more than once.

Description	Letter
A graph showing rapid population growth	
A graph where the population is declining	
A graph where the overall female population is smaller than the male population	
A graph representing a developed country	
A graph that shows a high birth rate and a high death rate	
A graph that shows a population with a long life expectancy	

(6)

1.6 Study the infographic below on the poaching of pangolin.

THE PLIGHT OF THE PANGOLIN

THE WORLD'S MOST ILLEGALLY TRADED MAMMAL

WHAT IS A PANGOLIN?

With their scale-covered bodies and super-long tongues, pangolins are one of the most unusual mammals in the wild today.



WHERE ARE THEY FOUND?

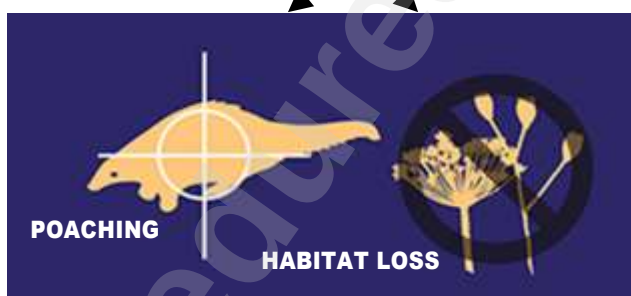
Pangolins can be found throughout tropical Asia and many parts of sub-Saharan Africa.

USES OF PANGOLINS AND THEIR PARTS

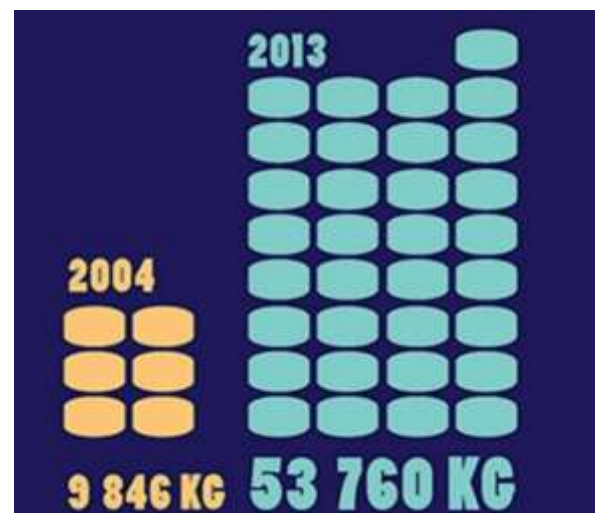


All eight species of pangolin face the threat of extinction.

Main threats



Mass of pangolin and their products that were found with captured poachers in 2004 and 2013.



[Adapted: <<https://www.ifaw.org>> & <<http://geographical.co.uk>>]

1.6.1 The five statements in the table below refer to the infographic on page x. For each statement decide whether:

A: the statement is supported by the information in the infographic.

B: the statement is contradicted by the information in the infographic.

C: the statement is neither supported nor contradicted by the information in the infographic.

	Statement	A, B or C
(a)	The only threat to pangolins is poaching.	
(b)	The eight species of pangolin are all at risk of extinction.	
(c)	Seizures of poached pangolin products doubled between 2004 and 2013.	
(d)	Pangolins in Africa are at higher risk of being poached than pangolins in Asia.	
(e)	Pangolins are used in traditional medicine.	

(5)

1.6.2 Pangolins in South Africa are close to extinction. Suggest a practical measure that can be put in place to reduce the number of pangolins poached. In your answer also explain why this measure would be effective.

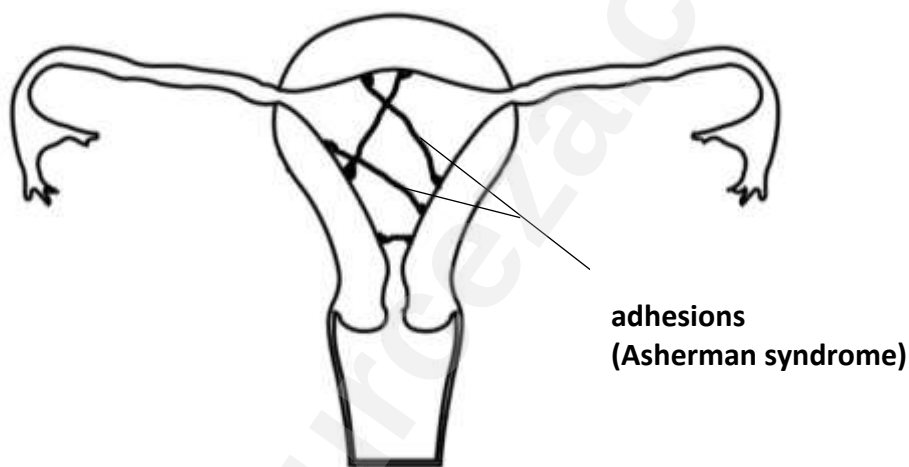
(3)

1.7 Read the article below and answer the questions that follow.

Asherman syndrome

Asherman syndrome affects a significant number of women who have had a dilation and curettage (D&C). A D&C is a surgical procedure that involves widening the cervix and removing the tissue lining of the uterus usually after the termination of a pregnancy or a miscarriage. Damage to the inner wall of the uterus leads to adhesions (scar tissue) that cause the tissues to stick together and this can block the cervix. It reduces menstrual flow or stops periods altogether and could cause infertility if the adhesions are not removed.

Diagram showing female reproductive organs with Asherman syndrome



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

[Adapted: <<http://www.totalhealth.co.uk>>]

1.7.1 Label the cervix, fallopian tubes and vagina on the diagram. (3)

1.7.2 Draw the ovaries on the diagram above and label them. (2)

1.7.3 Provide the correct biological term for the lining of the uterus.

(1)

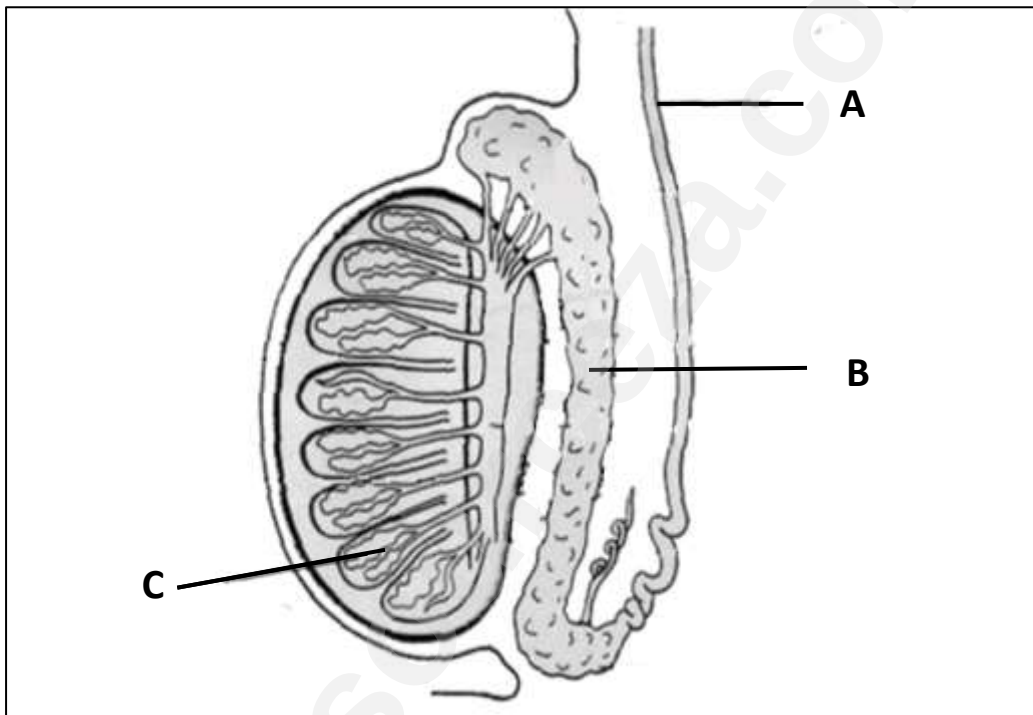
1.7.4 Explain ONE reason why Asherman syndrome could lead to infertility in women.

(2)

- 1.7.5 Would a woman with Asherman syndrome still be able to ovulate? Provide a reason to explain your answer.

(2)

- 1.8 The diagram below shows the testis of a mammal.



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

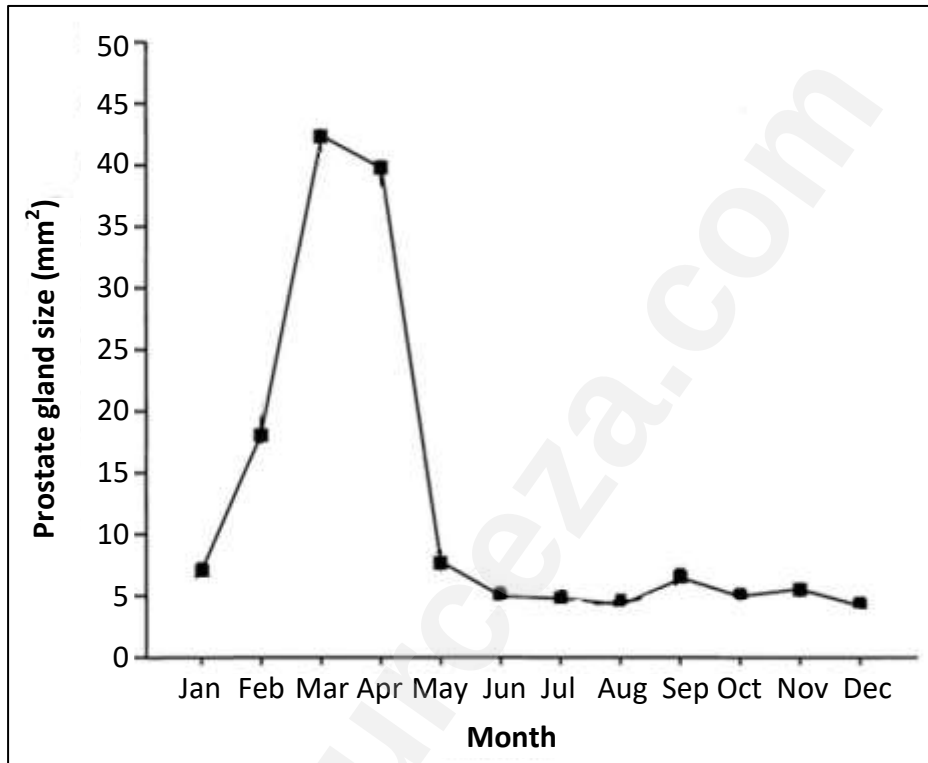
- 1.8.1 Complete the table below by filling in the name of structures A, B and C and the function of each structure.

	Name of structure	Function
A		
B		
C		

(6)

- 1.8.2 The graph below shows the size of the prostate gland in a male bat over a period of a year. The function of the prostate gland is similar in both bats and humans.

Graph showing the size of the prostate gland of a male bat over a period of one year



[Adapted: <<https://academic.oup.com>>]

- (a) What is the function of the prostate gland?
-
-
- (2)
- (b) What is the size of the prostate gland during the month of October?
-
- (1)
- (c) Use data from the graph to suggest the months when the breeding season of bats occurs.
-
- (2)
- (d) Explain how you got to your answer in Question 1.8.2 (c).
-
-
- (2)