



NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION MARCH 2017

LIFE SCIENCES: PAPER I

Time: 3 hours


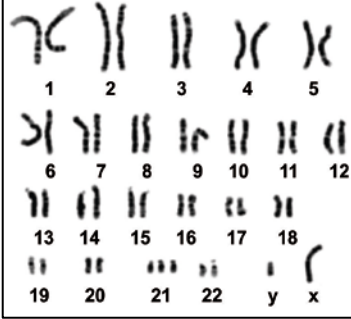

200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 11 pages and a yellow Answer Booklet of 10 pages (i–x). Please check that your question paper is complete. Detach the yellow Answer Booklet from the middle of the question paper.
 2. This question paper consists of four questions.
 3. Question 1 must be answered in the yellow Answer Booklet provided. Questions 2, 3 and 4 must be answered in your Answer Book.
 4. Read the questions carefully.
 5. Number the answers exactly as the questions are numbered.
 6. Use the total marks for each of Questions 1, 2, 3 and 4 as an indication of the detail required.
 7. It is in your own interest to write legibly and to present your work neatly.
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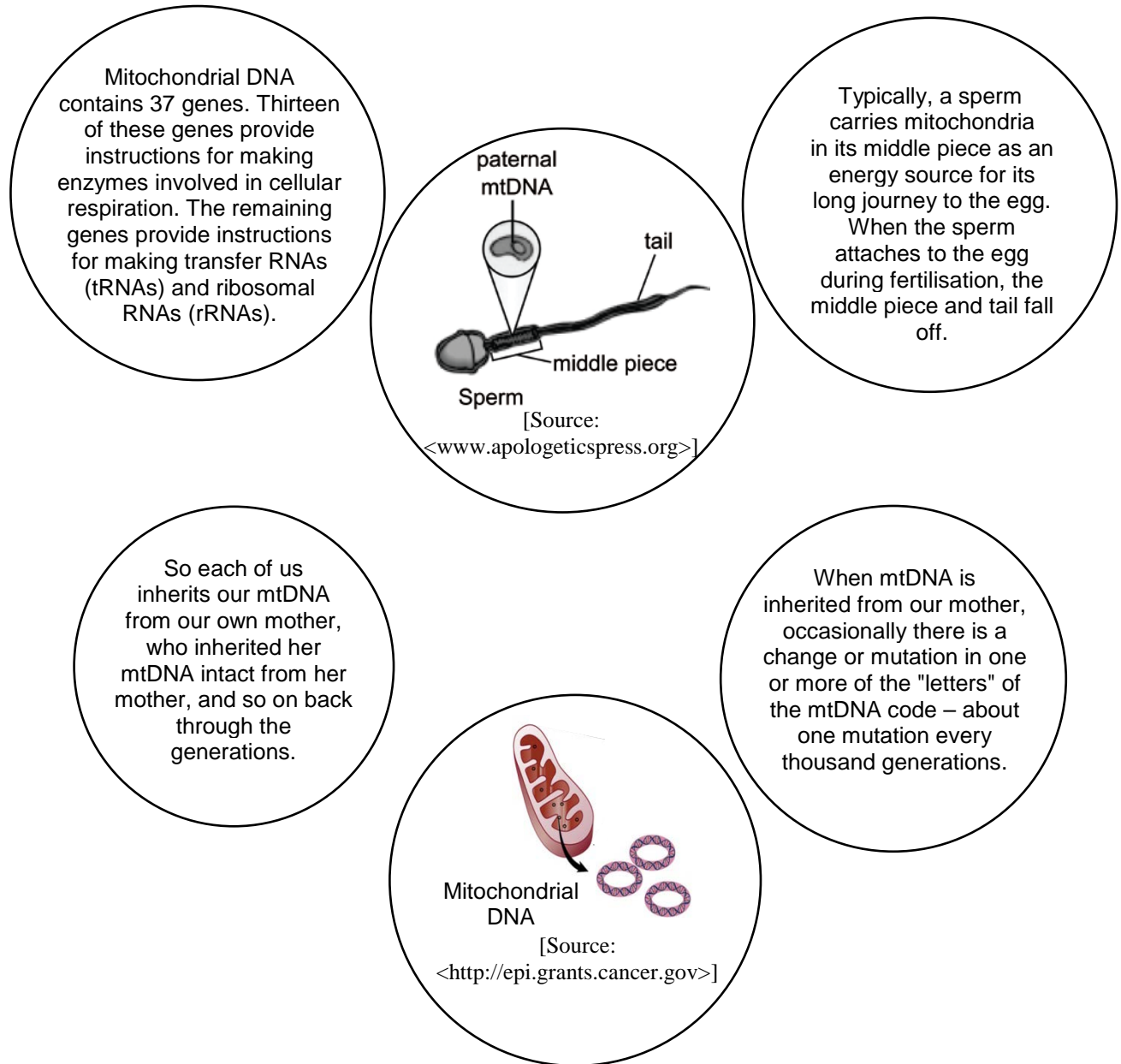
QUESTION 2

- 2.1 Below are photographs of a boy (A) and a girl (B) as well as a "photograph/micrograph" showing the chromosomes of one of these children. Answer the questions that follow:

		
<p>[Source: <http://www.soundtherapypertth.com>]</p>	<p>[Source: <http://www.aikenupsidedowns.org>]</p>	<p>[Source: <https://www.lifesitenews.com>]</p>

- 2.1.1 Name the genetic condition shown in the photographs above and explain how this condition usually arises. (4)
- 2.1.2 Consider the central "photograph/micrograph":
- What is the correct name for this "photograph/micrograph"? (1)
 - To which child (A or B) does this "photograph/micrograph" refer? Give a reason for your choice. (2)
- 2.1.3 There are a number of optional genetic tests that can be offered to a pregnant mother to determine if her unborn foetus has this condition. Would you advise a 35-year-old pregnant woman to have one of these tests? Give TWO reasons to justify your answer. (2)

- 2.2 Below are a number of "fact bubbles" containing information about human mitochondrial DNA (mtDNA). Use these bits of information to answer the questions that follow.

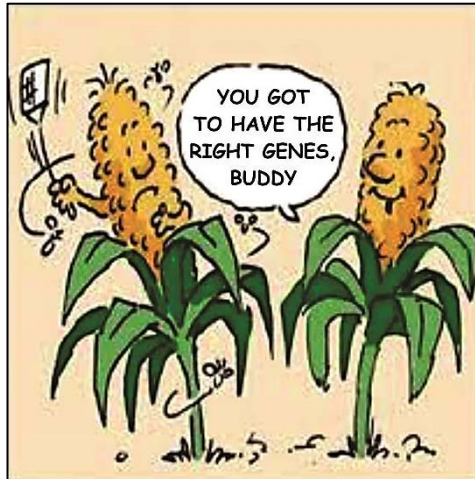


- 2.2.1 Explain why we inherit our mtDNA **ONLY** from our mothers. (4)
- 2.2.2 Why is mtDNA more reliable than nuclear DNA in establishing ancestry? (2)
- 2.2.3 Draw up a table in which you compare mtDNA and nuclear DNA. You must note **THREE** differences. (8)

2.3 Genetically Modified (GM) crops are now grown around the world. Since they were approved for commercial use in 1996, their production has increased dramatically. Very few products do not contain some form of GM ingredient.

2.3.1 What is meant by the term "Genetically Modified crop"? (2)

2.3.2 The following cartoon shows one of the advantages of certain GM crops. Explain the message in this cartoon.



[Source: <<http://www.seriouswonder.com>>]

(3)

2.4

A newly approved crop is this apple from a Canadian biotech company that does not brown even after it's been sliced – these are called "Arctic Apples". It recently received FDA* approval. The agency said it is safe to eat, which means they may appear on supermarket shelves.

*FDA = Food & Drug Administration



[Adapted from: <<http://time.com/3840073/gmo-food-charts>>]

2.4.1 If you were a parent buying apples for your family, would you buy these GM apples? Justify your answer with TWO reasons. (2)

- 2.4.2 A scientist heard about the new GM Arctic Apples and he decided to do his own tests on the apples comparing them to "natural" apples. He took a "natural" apple and an Arctic Apple and cut each apple in half. Over the next two hours, he observed the percentage of the cut surface that turned brown and recorded it in a table every 15 minutes.

Time (min)	"Natural" Apple (% brown)	Arctic Apple (% brown)
0	0	0
15	4	0
30	10	0
45	15	0
60	15	0
75	25	5
90	40	5
105	50	5
120	50	5

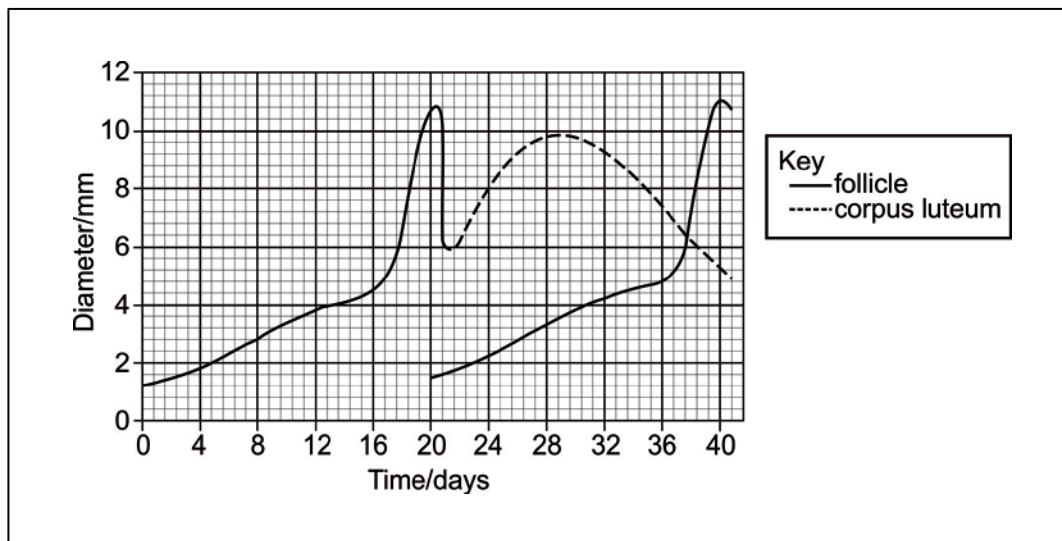
[Examiner's hypothetical data]

- (a) State the independent variable in this experiment. (2)
- (b) State the dependent variable in this experiment. (2)
- (c) Did his observations support the claims made by the producers of the Arctic Apple? Explain. (2)
- (d) Identify TWO fixed variables. (2)
- (e) How could the scientist have made sure his results were more reliable? (2)

[40]

QUESTION 3

- 3.1 The graph below shows changes in the diameters of a follicle and corpus luteum in the ovary of a pig over a period of 40 days.



[Adapted from: *Advanced Biology*. Jones & Jones. 1997]

- 3.1.1 Define the following terms:

(a) Graafian Follicle

(1)

(b) Corpus Luteum

(1)

- 3.1.2 **Describe** and **explain** the shape of the graph from Day 0 to Day 20. (4)

- 3.1.3 What event occurs at Day 20? Support your answer with evidence from the graph. (3)

- 3.1.4 Describe the role played by pituitary hormones in controlling the changes in size of the follicle. (4)

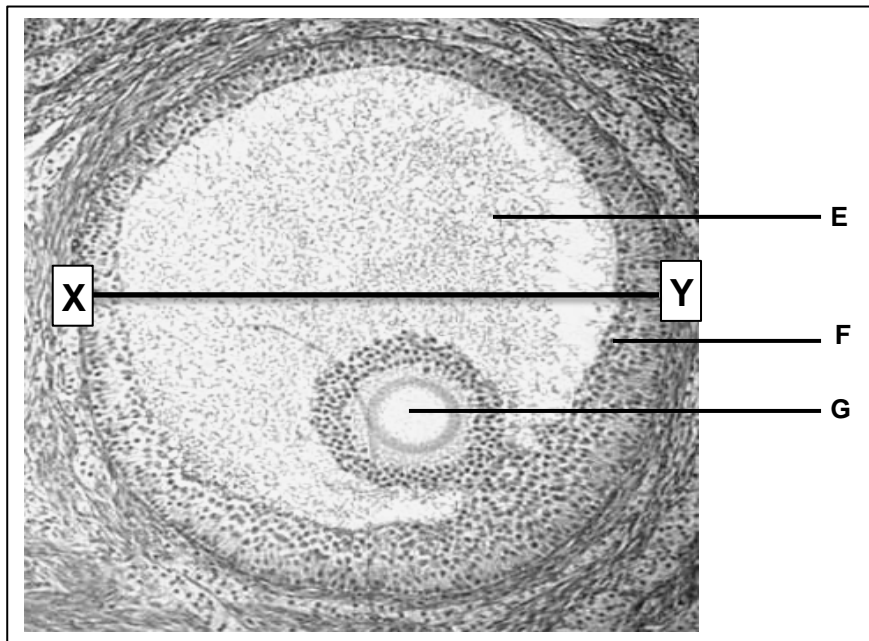
3.1.5 State the **name** and **function** of the main hormone produced by the ovary

(a) from Day 1 to Day 20. (2)

(b) from Day 21 to Day 30. (2)

3.1.6 In the cycle represented in the graph, did fertilisation occur? Give evidence from the graph to support your answer. (2)

3.2 The micrograph below is showing a section through a human Graafian follicle:



[Adapted from: <<https://core.ac.uk>>]

3.2.1 Complete the table by choosing the correct letter (E, F or G) from the micrograph:

Statement	Relates to which letter
Contains 23 chromosomes	(a)
Protective fluid	(b)
Composed of germinal epithelium	(c)

(3)

3.2.2 If the actual diameter of the follicle from X to Y is 12 mm, calculate the magnification of the micrograph. Show all working and express your answer rounded off to 1 decimal place. (4)

- 3.3 Pregnant women are offered many different tests to monitor the health of their developing babies. The photograph below shows the ultrasound scan of a foetus at 12 weeks of pregnancy. Ultrasound scans are done to ensure that the foetus is developing properly. Another test which is sometimes performed is called an amniocentesis test.



- 3.3.1 (a) Name the fluid labelled A. (1)
- (b) State THREE functions performed by fluid A. (3)
- 3.3.2 Give TWO reasons why a doctor might advise a woman to have an amniocentesis test. (2)
- 3.4 While modern agriculture relies on both asexual reproduction and genetic modification in order to produce high yields of the most desirable crops, many traditional subsistence farmers still rely on sexual reproduction to produce successful crops in our ever-changing climate.
- 3.4.1 Define the term "asexual reproduction". (2)
- 3.4.2 Discuss TWO benefits of asexual over sexual reproduction in agriculture. (2)
- 3.4.3 Explain how and why traditional subsistence farmers rely on sexual reproduction to produce crops that can cope with modern climatic conditions. (4)

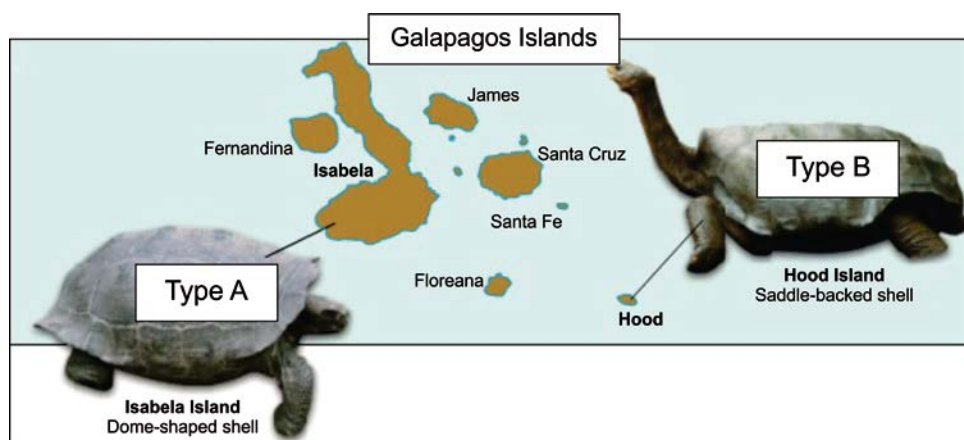
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QUESTION 4

"The theory of evolution is simple. It rests on three pillars: variation, selection and inheritance."

[Source: *New Scientist Magazine*: 22 March 2016]

- 4.1 Write a paragraph explaining Darwin's theory of evolution using these "three pillars". (6)
- 4.2 When Charles Darwin studied the fauna on the Galapagos Islands in 1835, he observed two different types of tortoise. One type had short necks and dome-shaped shells (Type A) while the other type had long necks and shells that rose up like a saddle in the front (Type B).



[Source: <<https://www.slideshare.net>>]

Type A tortoises were found on the larger islands where there was more rainfall and plenty of grass available. Type B tortoises were found on the smaller islands where the climate was drier and the vegetation was more sparse and higher off the ground.

- 4.2.1 What advantage would the Type B variety have over the Type A variety on the small, dry island? (4)
- 4.2.2 How would Darwin have explained the speciation of the Type B tortoise from its ancestral mainland species? (5)
- 4.2.3 What is the name of the process whereby nature "favours" certain individuals in a population over others? (1)

4.3

Colophon is a small genus of endangered beetles in the "stag beetle" family. There are 14 species of these stag beetles and all are flightless. They are endemic to South Africa, each restricted to its own mountain range or mountain peak (mostly between 1 000 m and 2 000 m elevation).

[Adapted from <<https://en.wikipedia.org>>]

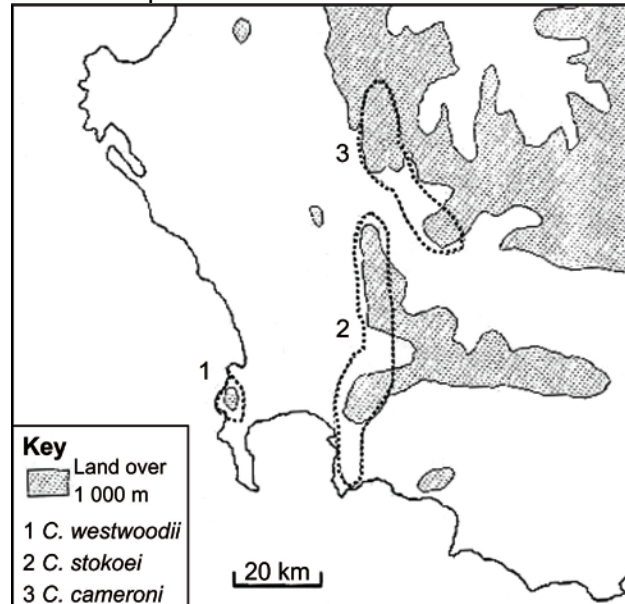
The dotted lines on the map below show the distribution of three of the species of **Colophon** in the Western Cape.

Diagram of *Colophon* sp.



[Source: <<https://s-media-cache-ak0.pinimg.com>>]

Map of SW coast of South Africa



[Source: *Advanced Biology*. Jones & Jones. 1997]

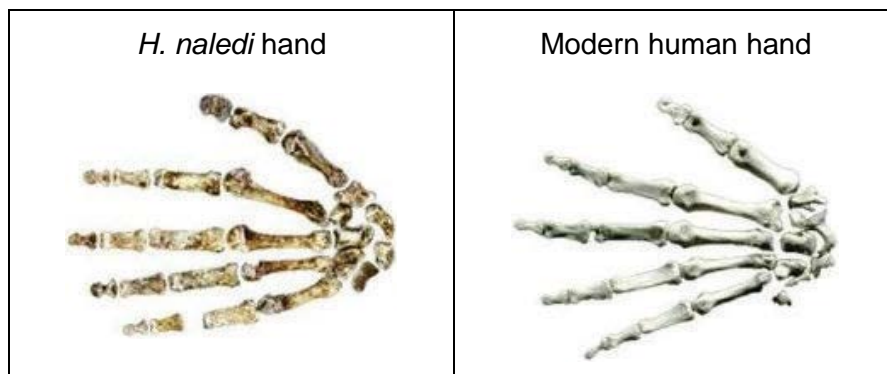
- 4.3.1 Define the term "species". (2)
- 4.3.2 What type of speciation occurred to cause the formation of 14 species of **Colophon**? (1)
- 4.3.3 Suggest an explanation for the following:
- (a) All three species of **Colophon** in the Western Cape are very similar in general appearance. (2)
 - (b) There are slight differences between the species of **Colophon** found in the three marked areas. (2)
 - (c) The fact that they are flightless and that they live in separate mountain ranges has been responsible for the evolution of the different species. (3)
- 4.3.4 Name and explain any TWO reproductive isolating mechanisms that prevent species from interbreeding. (4)

4.4 In 2015, Professor Berger of the University of the Witwatersrand announced the discovery of a hominid species never seen before. This new species, found in the Rising Star Cave just outside the Cradle of Humankind, was named ***Homo naledi***.

4.4.1 The word "***Homo***", used to describe the genus of this new species, gives us a clue about some of the features/behaviours of this newly-discovered fossil. State TWO features/behaviours that we can deduce from this word "***Homo***". (2)

4.4.2 Explain the economic importance to South Africa of the area known as the "Cradle of Humankind". (4)

4.4.3 The hand and wrist of ***Homo naledi*** are similar in structure to a human hand and wrist, but the fingers are longer and more curved.



[Source: <<https://s-media-cache-ak0.pinimg.com>>]

Discuss TWO aspects about the lifestyle of ***Homo naledi*** that you can deduce from the information and the picture of the hand of ***Homo naledi***. (4)
[40]

Total: 200 marks