GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2018

10832

LIFE SCIENCES

PAPER 2

TIME: 2½ hours

MARKS: 150

15 pages

X05

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

LIFE SCIENCES
(Paper 2)

TIME: 2½ hours

MARKS: 150

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Make ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, flow charts or tables only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You may use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

MULTIPLE-CHOICE QUESTIONS

1.1 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number (1.1.1. – 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following represents a single RNA nucleotide?

A Deoxyribose-adenine-thymine
B Adenine-ribose-phosphate
C Deoxyribose-thymine-phosphate
D Uracil-deoxyribose-phosphate

1.1.2 If parents have two sons, what are the chances of them having a daughter when they have a third child?

A 66%
B 75%
C 50%
D 25%

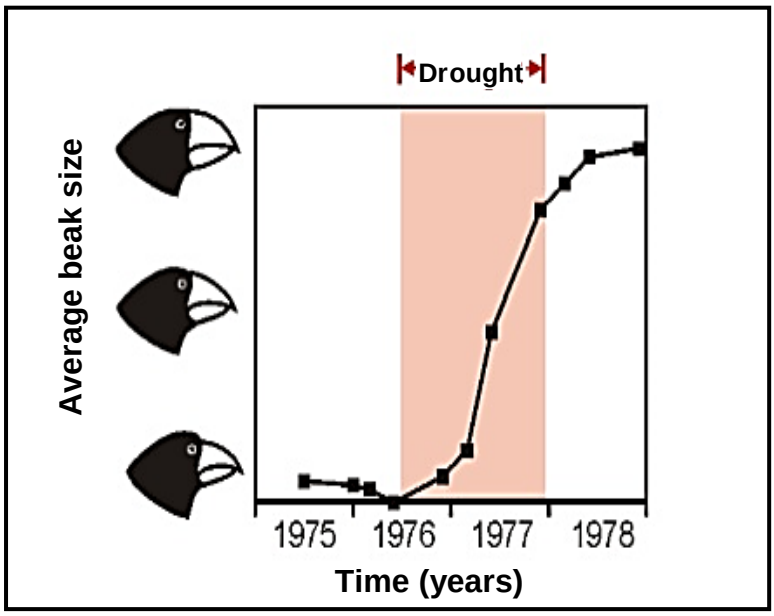
1.1.3 Which ONE of the following CORRECTLY describes the cells produced by meiosis?

	CELLS PRODUCED BY MEIOSIS	
	Chromosome complement	**Genetic composition**
A	Haploid	Different
B	Diploid	Identical
C	Diploid	Different
D	Haploid	Identical

1.1.4 The base sequence on a template strand of a DNA molecule is GTG CCA TTC. The corresponding codons on the RNA molecule formed during transcription will be…

A CAC GGU AAG.
B CAC GGT TTC.
C GUG CCA UUC.
D GUG CCA AAC.

1.1.5 During an investigation, researchers measured the beak size of a certain species of finch on the Galapagos Islands. The type of food available before and after a drought was a factor in the study of the evolution of the beaks of finches.



Which factor is the dependent variable?

A The amount of rain
B The type of food available
C The beak size of finches
D The year

1.1.6 The phase in which DNA replication takes place is called ...

A Prophase.
B Interphase.
C Metaphase.
D Anaphase.

1.1.7 The genotype of a plant which results from a cross between a plant with red seeds (RR) and a plant with white seeds (rr) is …

A RRrr.
B rr.
C RR.
D Rr.

1.1.8 What percentage of adenine bases is present in a DNA molecule of 2000 bases, if 400 bases are cytosine?

A 20
B 40
C 30
D 60

1.1.9 The two versions of a gene which influence the same characteristic in different ways are called …

A genotypes.
B phenotypes.
C mutations.
D alleles.

1.1.10 Which one of the following serves as evidence of cultural evolution in early *Homo* species?

A A skull of *Homo erectus* close to a *Homo sapiens* skeleton
B Remains of ancient tools
C Male and female skeletons in the same area
D Many *Homo* skeletons in an area

(10x2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 – 1.2.8) in your ANSWER BOOK.

1.2.1 The breeding of plants and animals to produce desirable characteristics

1.2.2 The type of genetic cross between two phenotypically different parents producing an offspring different from both parents but with an intermediate phenotype

1.2.3 The nitrogen base that always bonds with adenine in DNA

1.2.4 A group of similar organisms which interbreed successfully with each other to produce fertile offspring

1.2.5 The process whereby organisms better suited to their environment survive and produce more offspring

1.2.6 A theory that describes evolution as consisting of long periods of little or no change alternating with relatively short periods of rapid change

1.2.7 Species name of 'Mrs Ples'

1.2.8 Variation that results in distinct phenotypes

(8x1) **(8)**

1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY, B ONLY, BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only, B only, both A and B** or **none** next to the question number (1.3.1 – 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	A difference between humans and African apes	A B	Opposable thumbs Flattened face
1.3.2	Introduces variation to a species	A B	Random mating Mutation
1.3.3	An explanation of why some tortoises have long necks and some have short necks is from a theory by …	A B	Charles Darwin Watson and Kriek

(3x2) **(6)**

1.4 In the maternity ward of a hospital two new-born baby girls were mixed up. Baby **X** had blood group O and baby **Y** had blood group A. Both mothers thought that the baby with blood group O belonged to them. Mrs Kale had blood group AB and her husband Mr Kale, had blood group O. Mrs More had blood group A and her husband Mr More had blood group B.

1.4.1 Give the number of:

(a) Alleles controlling blood groups (1)
(b) Genes controlling blood groups (1)

1.4.2 Identify the type of dominance shown in the inheritance of blood groups. (1)

1.4.3 Identify:

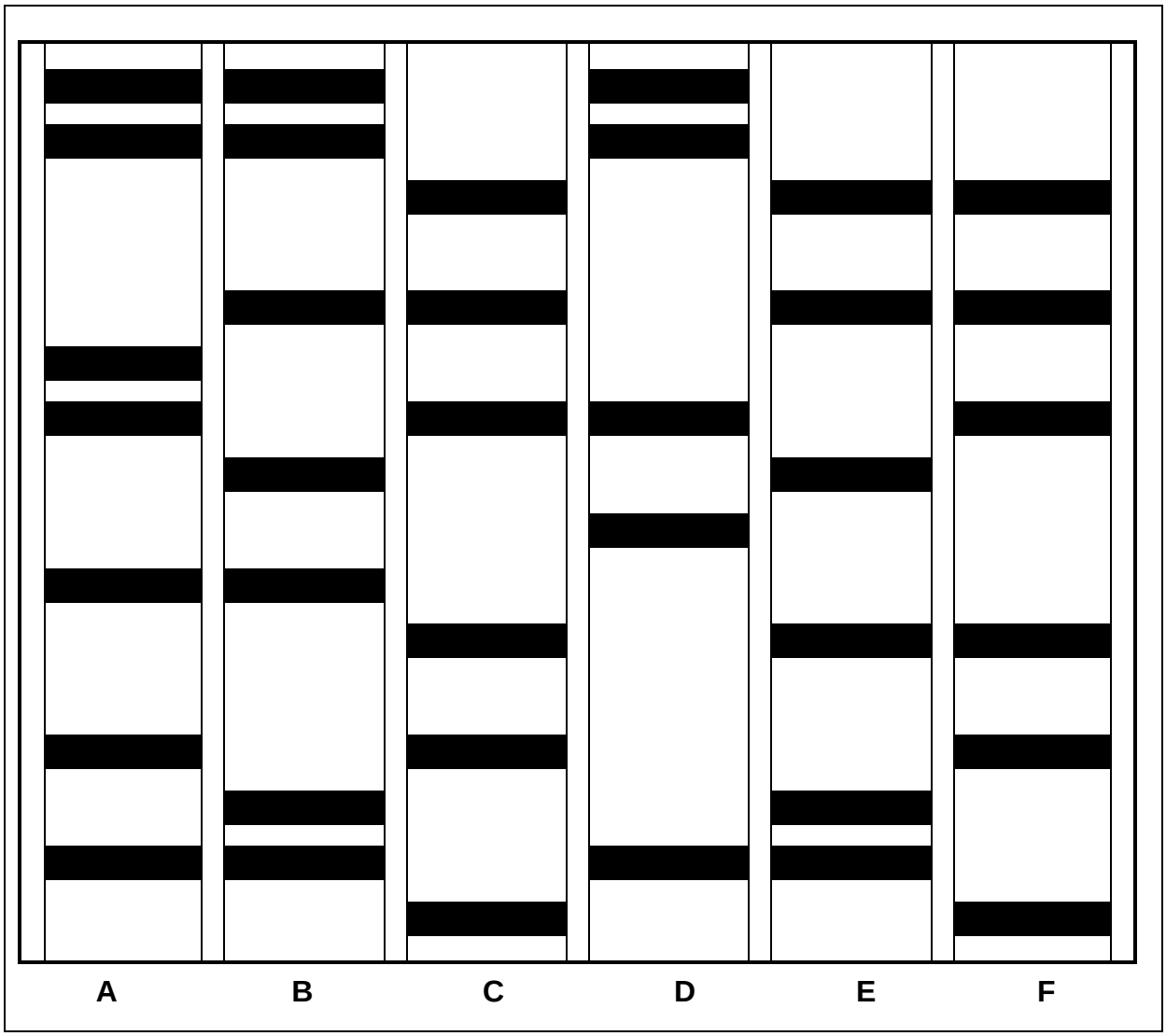
(a) The recessive allele (1)
(b) The two dominant alleles (2)

1.4.4 Write down the genotype of:

(a) Baby X (1)
(b) Baby Y (1)
(c) Mr More (1)

1.4.5 Is it possible for Mrs Kale to be the mother of Baby **X**? (1)
(10)

1.5 The diagram below shows the DNA profiles of six different people.



1.5.1 Give the letters of the TWO people who are identical twins. (2)

1.5.2 Give the letters of the parents of person **B**. (2)

1.5.3 Give TWO examples of how forensic scientists can use DNA profiling. (2)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The table below shows the amount of land cultivated by various GM crops in different countries.

Country	Cultivation area (Hectares)	Crops
Brazil	44 million	soybean, maize, cotton
Canada	11 million	maize, soybean, sugar beet
China	4 million	cotton, papaya
India	12 million	cotton
South Africa	2 million	maize, soybean, cotton

[Adapted from: *http://www.isaaa.org/resources/publications/pocketk/16/*]

2.1.1 State what is meant by *genetic modification*. (2)

2.1.2 What was the largest amount of land used to cultivate GM crops? (1)

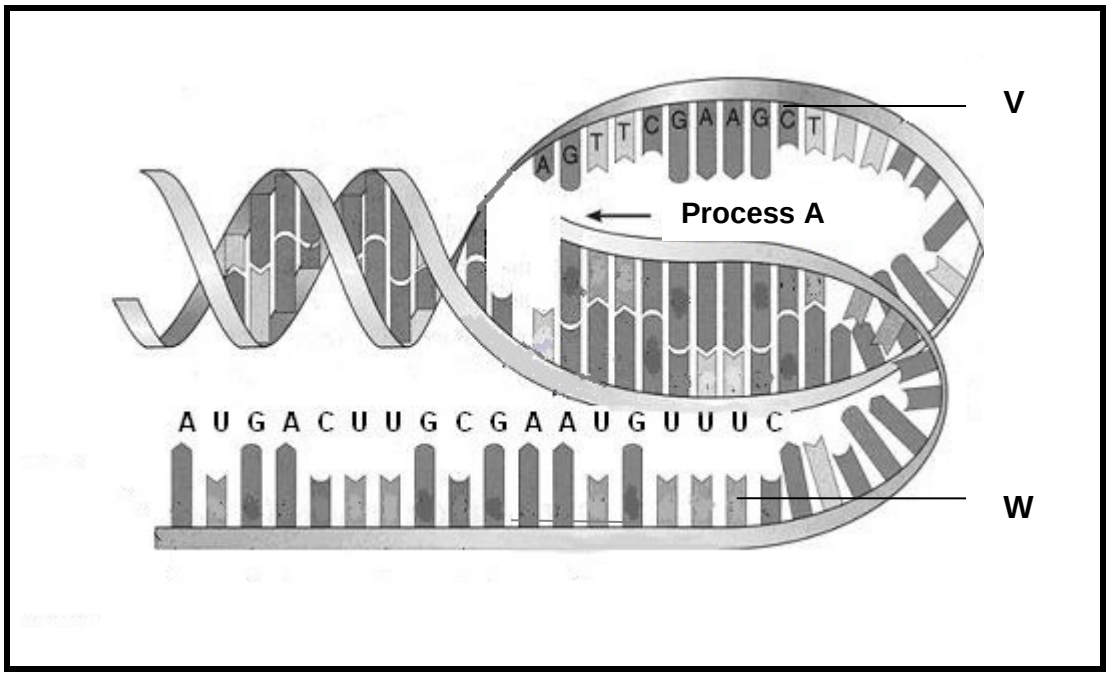
2.1.3 Which country cultivated the fewest number of GM crops? (1)

2.1.4 List ONE of the GM crops in the table that would not increase food security. (1)

2.1.5 Give THREE advantages of using genetically modified crops. (3)

2.1.6 Draw a bar graph showing the amount of land used for the cultivation of genetically modified crops for all countries. (6)
(14)

2.2 The diagram below shows a process occurring in a cell.



2.2.1 What is the segment of DNA called, that codes for a protein? (1)

2.2.2 Name the stage of protein synthesis shown. (1)

2.2.3 Identify the molecules labelled:

(a) **V** (1)
(b) **W** (1)

2.2.4 Name the type of proteins that control protein synthesis. (1)

2.2.5 Reading only the exposed and labelled nitrogenous bases of molecule **W** from left to right, how many amino acids are coded for? (1)

2.2.6 Name and describe the stage of protein synthesis that occurs in the cytoplasm and follows process **A**. (6)
(12)

2.3 In pea plants, tallness **(T)** is dominant over shortness **(t)** and green **(G)** seed is dominant over yellow **(g)** seed.
A pea plant, homozygous for both tallness and green seed, is crossed with a pea plant, homozygous for both shortness and yellow seed.

2.3.1 List ALL the possible genotypes of the:

(a) P_1 generation (2)
(b) F_1 generation (2)

2.3.2 List all the possible gametes of the F_1 generation mentioned in QUESTION 2.3.1. (2)
(6)

2.4 "**Brachydactyly** is characterised by a shortening of the fingers and toes due to unusually short bones. This is an inherited condition, which is controlled by a **dominant allele**. In most cases it does not present any problems for the person who has it."

[Adapted from: *www.healthline.com*]

Genotypes of a family having the condition are shown in the table below.

Generation		Name	Genotype
1	Mother	Thandi	
2	Father	Simon	bb
3	Son	Brian	Bb
4	Daughter	Zola	Bb
5	Daughter	Lindi	bb
6	Husband of Lindi	Bongani	Bb
7	Granddaughter	Tumi	bb

2.4.1 Give the phenotype of:

(a) Zola (1)
(b) Tumi (1)

2.4.2 Give the genotype of Thandi. (1)

2.4.3 Explain why Lindi did not inherit the disorder. (4)

2.4.4 What are the chances of Lindi and Bongani having a child with brachydactyly? (1)
(8)
[40]

QUESTION 3

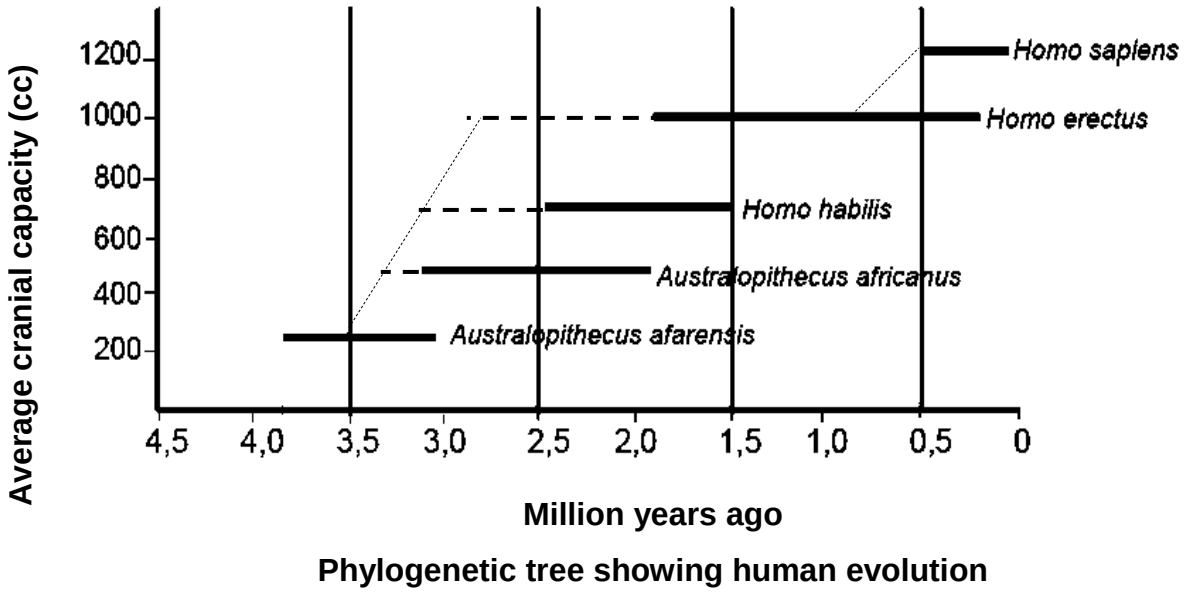
3.1 Analysis of mitochondrial DNA is used as evidence of human evolution.

3.1.1 What type of evidence does mitochondrial DNA represent? (1)

3.1.2 Briefly describe why humans inherit mitochondrial DNA from only the mother. (3)

3.1.3 Briefly describe how analysis of mitochondrial DNA, fossil and cultural evidence support the "Out of Africa" hypothesis. (5)
(9)

3.2 The phylogenetic tree below shows a possible representation of human evolution from early human ancestors.



Phylogenetic tree showing human evolution

[Adapted from *Biology: Understanding Life, Sandra Alter, 1995*]

3.2.1 According to this phylogenetic tree, when did human ancestors first appear? (1)

3.2.2 Which species is the closest relative of *Homo erectus?* (1)

3.2.3 Which species lived at the same time as both *Australopithecus afarensis* and *Homo habilis*? (1)

3.2.4 Calculate the percentage increase in average cranial capacity from *Australopithecus africanus* to *Homo sapiens*. (3)

3.2.5 Suggest a reason why *Homo habilis,* which means "handy man", was given that name. (1)
(7)

3.3 Read the extract below and answer the questions that follow.

> Penguins are arctic birds that have small wings which they do not use for flight. They do, however have to dive up to 450 metres into the water to feed on fish. Penguins cannot breathe under water and need to hold their breaths for more than 20 minutes whilst hunting.

[Adapted from: *National Geographic, May 20, 2013*]

3.3.1 Explain how the small wings of the penguin could be an advantage when obtaining food. (2)

3.3.2 Use Lamarck's theory (laws) to explain the small wings of modern penguins. (6)
(8)

3.4 Scientists conducted a survey to establish the relationship between the age of the mother and the risk of her having a baby with Down syndrome. They recorded the number of babies born with Down syndrome (per 5 000 births) over a one year period and recorded the age of the mother. Their findings are summarised in the table below.

Age of mother (years)	**Number of babies born with Down syndrome (per 5 000 births)**
25	10
35	15
45	300

3.4.1 Which age of mother has the highest risk of having a baby with Down syndrome? (1)

3.4.2 Describe FOUR planning steps for this survey. (4)

3.4.3 State the:

(a) Independent variable (1)
(b) Dependent variable (1)

3.4.4 State ONE way of improving the reliability of the results. (1)

3.4.5 State a conclusion for this survey. (2)
(10)

3.5 A new frog species was discovered in the Western Cape, and because it looks like a strawberry it has been named the **Strawberry Frog**. It closely resembles a group of frogs called **Poison Dart Frogs**, found in Central and South America and it is believed that they may have a common ancestor

[Adapted from: *http://www.tourismtattler.com*]

Describe the speciation of these frogs. **(6)**

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe the characteristics of the skull of *Homo sapiens* (humans) that differentiates them from African apes. Also explain how the differences in the human skeleton and that of African apes result in different modes of locomotion.

Content: **(17)**
Synthesis: **(3)**

NOTE: NO marks will be allocated for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C: 20

TOTAL: 150

END