KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES

COMMON TEST

APRIL 2021

MARKS: 60

TIME: 1 hour

This question paper consists of 9 pages.

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. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts 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.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.3) in the ANSWER BOOK, for example 1.1.4 D.

1.1.1 The amniotic fluid in the amniotic egg …

A removes waste products
B provides nutrition to the developing embryo
C protects the embryo against mechanical injuries
D allows gaseous exchange

1.1.2 The following combination of characteristics represent precocial development.

(i) Offspring capable of moving around soon after hatching
(ii) Offspring with eyes closed and unable to move after hatching
(iii) Offspring capable of feeding themselves soon after hatching
(iv) Offspring nests usually on top branches of the tree

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

1.1.3 The phase of meiosis where chromatids are pulled to the opposite poles.

A Anaphase I
B Anaphase II
C Metaphase I
D Metaphase II (3 x 2) **(6)**

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 to 1.2.4) in the ANSWER BOOK.

1.2.1 The original strand of DNA used to form another strand of DNA

1.2.2 A pattern of black bars representing DNA fragments that can be used to identify dead bodies

1.2.3 The type of RNA that attaches to the ribosome during protein synthesis

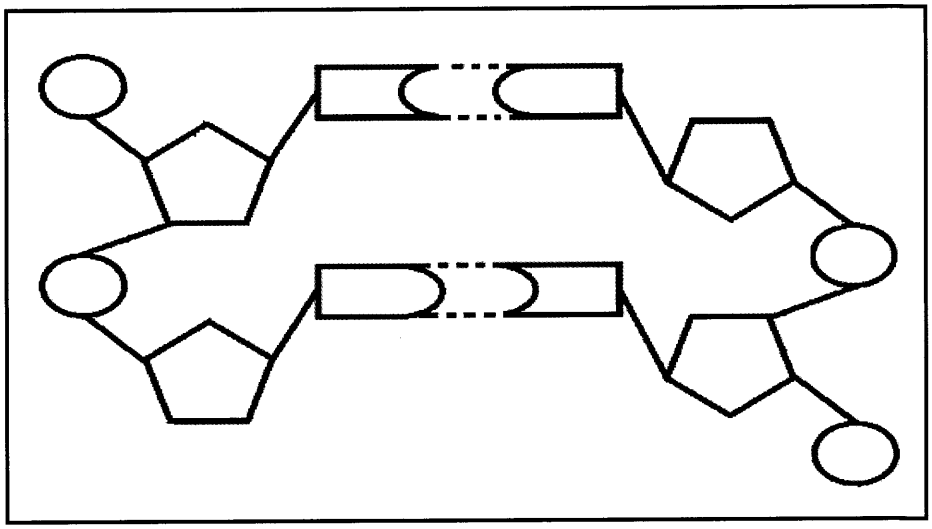
1.2.4 Type of fertilisation where a sperm cell fuses with an ovum outside the female body (4 x 1) **(4)**

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 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	**COLUMN II**
1.3.1	Chromosomes arranged along the equator in a single row	A: Metaphase I B: Metaphase II
1.3.2	Embryo is nourished with yolk found in the egg	A: Ovipary B: Vivipary
1.3.3	Chromosome number in gametes	A: Haploid B: Diploid

(3 x 2) **(6)**

1.4 The diagram below represents a part of the structure of a nucleic acid.



1.4.1 Identify the molecule above. (1)

1.4.2 Give an observable reason for your answer in QUESTION 1.4.1. (1)

1.4.3 Name TWO locations where the above molecule is found in animal cells. (2)
(4)

TOTAL SECTION A: 20

SECTION B

QUESTION 2

2.1 Albumin is a single chain globular protein made up of 585 amino acids. A small section of the DNA sequence coding for the formation of albumin is shown below.

TABLE A

1	2	3	4	5	6
TGC	GAG	GTG	GAT	AAG	CGT

2.1.1 Write down the anticodon of the DNA base triplet **6**. (1)

2.1.2 Describe the role of tRNA in protein synthesis. (2)

2.1.3 How many nitrogenous bases are found in the mRNA molecule coding for the formation of the albumin protein? Show ALL working. (2)

2.1.4 The table below shows the base triplets in mRNA that code for different amino acids found in albumin.

TABLE B

AMINO ACID	mRNA
Arginine	GCA
Cysteine	ACG
Lysine	UUC
Aspartic acid	CUA
Histidine	CAC
Glutamic acid	CUC

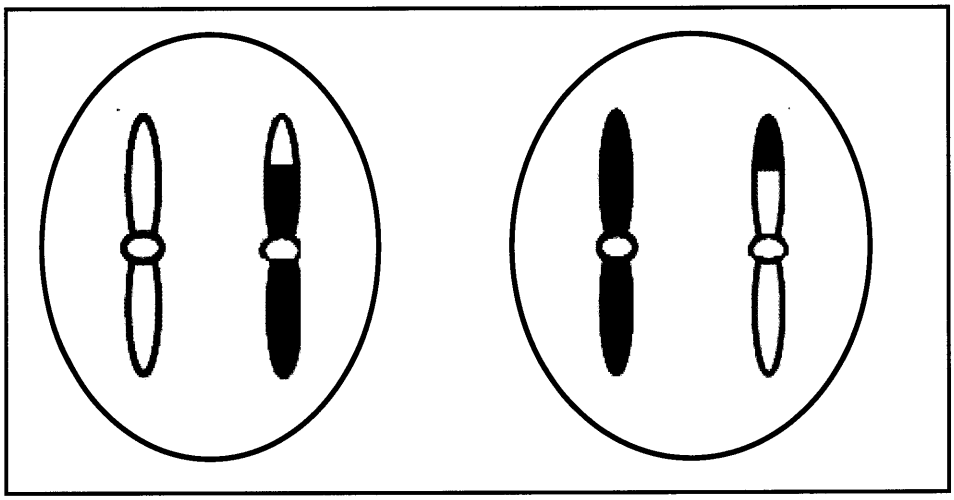
Using **TABLE B** above, name the amino acid coded for by the DNA base triplet as shown in **TABLE A**:

(a) **1** (1)

(b) **4** (1)

2.1.5 Describe the process of *transcription*. (6)
(13)

2.2 The diagrams below represent cells in a phase of meiosis.



2.2.1 Which phase of meiosis is represented by the diagrams above? (1)

2.2.2 State TWO processes that resulted in the appearance of chromosomes in the diagram above. (2)

2.2.3 Draw a labelled diagram to show the cell before the phase shown in the diagrams above. (4)
(7)
[20]

QUESTION 3

3.1 An investigation was conducted to determine the effect of high amounts of progesterone on FSH production in human females.

The procedure was as follows:

- 20 healthy women who are not pregnant were used.
- The women are all of the same age.
- They were divided into 2 groups (Groups **A** and **B**).
- Each group had 10 participants.
- Their FSH levels were determined and recorded before the investigation.
- Group **A** was injected with the progesterone injection which takes 13 weeks to metabolise in the body.
- Group **B** was not treated with the progesterone injection.
- Both groups were exposed to the same environmental conditions for 3 months.
- Their FSH levels were recorded on day 3 of every menstrual cycle for the duration of the investigation.
- The average FSH levels of both groups was calculated.

The results are shown in the table below.

GROUP	AVERAGE FSH LEVEL IN THE BLOOD (mIU/mL)
A	3.1
B	9.5

3.1.1 Identify the independent variable in the investigation. (1)

3.1.2 Name TWO factors that were kept constant during the selection of participants. (2)

3.1.3 Explain why Group **B** was included in the investigation. (2)

3.1.4 Explain why the average FSH level in the blood in group **A** is low. (2)
(7)

3.2 The table below shows the testosterone levels in the blood of male in different ages.

AGE (YEARS)	TESTOSTERONE LEVELS (ng/dl)
35-44	667
45-54	606
55-64	562
65-74	523
75-84	470

3.2.1 Name the part of the male reproductive system that:

(a) Secretes testosterone (1)

(b) Stores sperm cells (1)

3.2.2 According to the table above, what is the testosterone level in a 57 year old male? (1)

3.2.3 Describe the relationship between the age and the testosterone levels shown in the table above. (2)

3.2.4 Explain what will be the effect on reproduction if the testosterone levels of 35 year old male is 0 ng/dl? (2) **(7)**

3.3 Describe the process of *oogenesis*. **(6) [20]**

TOTAL SECTION B: 40

GRAND TOTAL: 60

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MARKING GUIDELINE

MARKS: 60

This marking guideline consists of 6 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. If more information than marks allocated is given
Stop marking when maximum marks is reached and put a wavy line and 'max' in the right-hand margin.

2. If, for example, three reasons are required and five are given
Mark the first three irrespective of whether all or some are correct/incorrect.

3. If whole process is given when only a part of it is required
Read all and credit the relevant part.

4. If comparisons are asked for, but descriptions are given
Accept if the differences/similarities are clear.

5. **If tabulation is required, but paragraphs are given**
Candidates will lose marks for not tabulating.

6. If diagrams are given with annotations when descriptions are required
Candidates will lose marks.

7. If flow charts are given instead of descriptions
Candidates will lose marks.

8. If sequence is muddled and links do not make sense
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.

9. Non-recognised abbreviations
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation, but credit the rest of the answer if correct.

10. Wrong numbering
If answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.

11. **If language used changes the intended meaning**
Do not accept.

12. Spelling errors
If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.

13. If common names are given in terminology
Accept, provided it was accepted at the national memo discussion meeting.

14. **If only the letter is asked for, but only the name is given (and vice versa)**
Do not credit.

15. If units are not given in measurements
Candidates will lose marks. Memorandum will allocate marks for units separately.

16. **Be sensitive to the sense of an answer, which may be stated in a different way.**

17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.

SECTION A

QUESTION 1

1.1 1.1.1 C✓✓
1.1.2 D✓✓
1.1.3 B✓✓
(3 x 2) **(6)**

1.2 1.2.1 Template✓
1.2.2 DNA profile✓
1.2.3 mRNA✓
1.2.4 External✓ fertilisation
(4 x 1) **(4)**

1.3 1.3.1 B only✓✓
1.3.2 A only✓✓
1.3.3 A only✓✓
(3 x 2) **(6)**

1.4 1.4.1 DNA✓ (1)
1.4.2 -Double stranded✓
-Weak hydrogen bonds Any (1)
1.4.3 - Nucleus✓
- Mitochondrion✓ (2)
Mark first TWO only **(4)**

TOTAL SECTION A: 20

SECTION B

QUESTION 2

2.1 2.1.1 CGU✓ (1)

2.1.2 Brings required amino acids✓ to the ribosomes✓ to form the required proteins (2)

2.1.3 585 x 3✓ = 1755✓ (2)

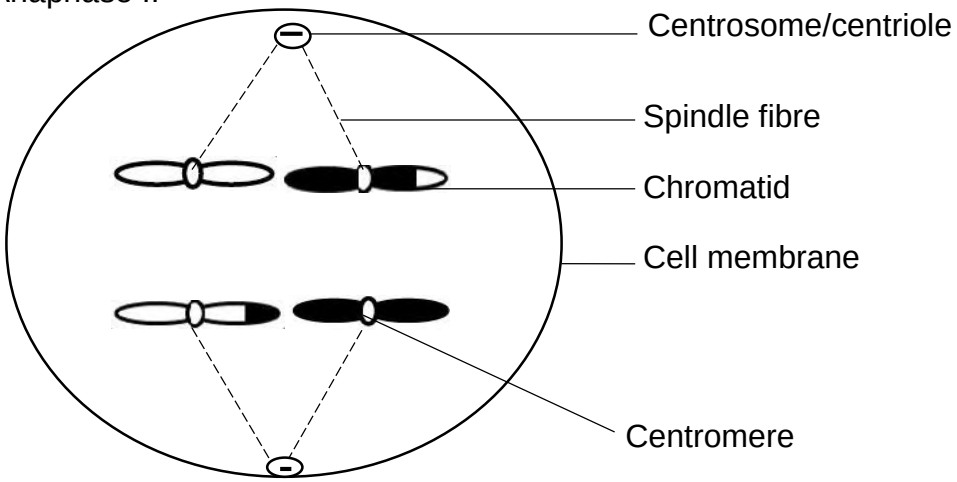
2.1.4 (a) Cysteine✓ (1)
(b) Aspartic acid✓ (1)

2.1.5 - The double helix DNA unwinds✓
- The double-stranded DNA unzips✓/weak hydrogen bonds break
- to form two separate strands✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides✓ from the nucleoplasm
- The mRNA is complementary to the DNA✓
- mRNA now has the coded message for protein synthesis✓ Any (6)
(13)

2.2 2.2.1 Telophase II✓ (1)

2.2.2 - Crossing over✓
- Random arrangement✓ (2)
(Mark first TWO only)

2.2.3 Anaphase II



Marking criteria:

Caption	1
Correct type of diagram with the correct shading and correct position (4 chromatids arranged correctly)	1
Any two correct labels	2

(4)
(7)

[20]

QUESTION 3

3.1	3.1.1	High amounts of progesterone✓		(1)
	3.1.2	- All healthy females✓ - No pregnant females✓ - Age✓ **(Mark first TWO only)**	Any	(2)
	3.1.3	- To serve as control✓ - so that it can be compared with group A✓ - It shows that progesterone is the only factor that affects the results✓/ improves validity of the investigation	Any	(2)
	3.1.4	- High amounts of progesterone✓in the blood - inhibited FSH production✓		(2) **(7)**
3.2	3.2.1	(a) Testes✓ (b) Epididymis✓		(1) (1)
	3.2.2	562✓		(1)
	3.2.3	As the age increases, the testosterone level in the blood of males decreases✓✓		(2)
	3.2.4	- No spermatogenesis will occur✓ - therefore, semen produced will have no sperm cells✓ - to fertilise the ovum✓	Any	(2) **(7)**
3.3		- Under the influence of FSH✓ - diploid cells✓/germinal epithelial cells - in the ovary - undergo mitosis✓ - to form numerous follicles✓ - One cell inside a follicle enlarges and undergoes meiosis✓ - Of the four cells that are produced, only one survives to form a mature, haploid ovum✓	Any	**(6)** **[20]**

TOTAL SECTION B: 40

GRAND TOTAL: 60

