Education

KwaZulu-Natal Department of Education

GRADE 12

NATIONAL SENIOR CERTIFICATE

LIFE SCIENCES

COMMON TEST

JUNE 2020

MARKS: 150

TIME: $2^1/_2$ hours

N.B. This question paper consists of 15 pages including this page.

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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, 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 must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

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SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.9) in your ANSWER BOOK, for example 1.1.10 D.

1.1.1 A DNA nucleotide consists of a …

A ribose sugar, four nitrogenous bases and a phosphate group.
B phosphate group and a nitrogenous base.
C deoxyribose sugar and four nitrogenous bases.
D deoxyribose sugar, a nitrogenous base and a phosphate group.

1.1.2 Which ONE of the following involves the development of the young inside the uterus of the mother and where it receives nutrients through the placenta?

A Ovipary
B Vivipary
C Ovovivipary
D Amniotic egg

1.1.3 Below is a list of terms relating to reproduction:

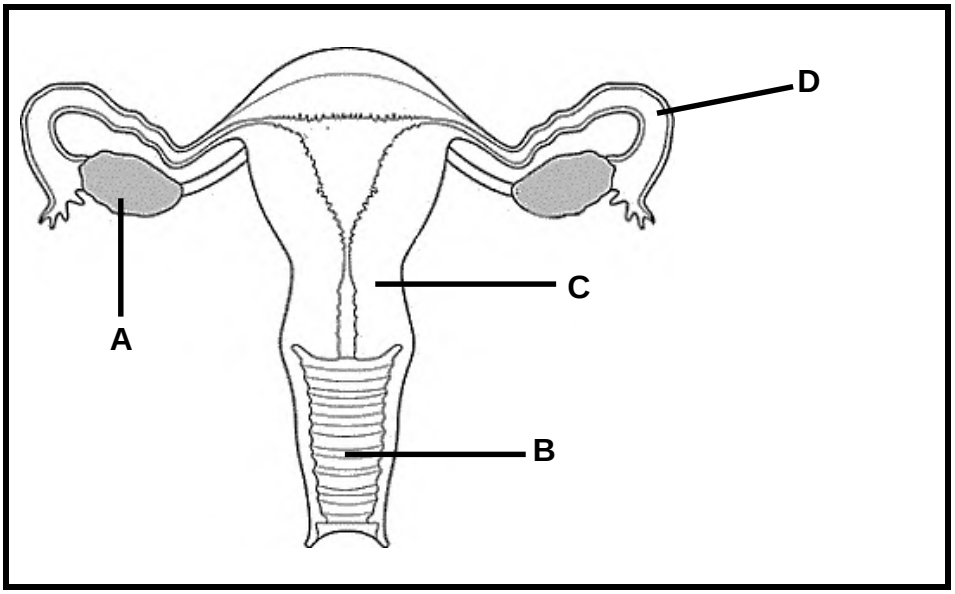
(i) Precocial development
(ii) Altricial development
(iii) Amniotic egg
(iv) Parental care

Which of the terms above refer to strategies used by birds that incubate their eggs in a nest and feed their young until they are able to fly?

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

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QUESTION 1.1.4 AND 1.1.5 ARE BASED ON THE FOLLOWING DIAGRAM.



1.1.4 Which part is the site for fertilisation?

A **A**
B **B**
C **C**
D **D**

1.1.5 Which ONE of the following is the CORRECT MATCH of the label and function?

	PART	FUNCTION
A	**A** - Fallopian tube	Transport oestrogen to the endometrium
B	**B** - Vagina	Ovulation
C	**C** - Uterus	Site for implantation of embryo
D	**D** - Ovary	Produces haploid egg cells

1.1.6 Below is a list of steps involved in protein synthesis

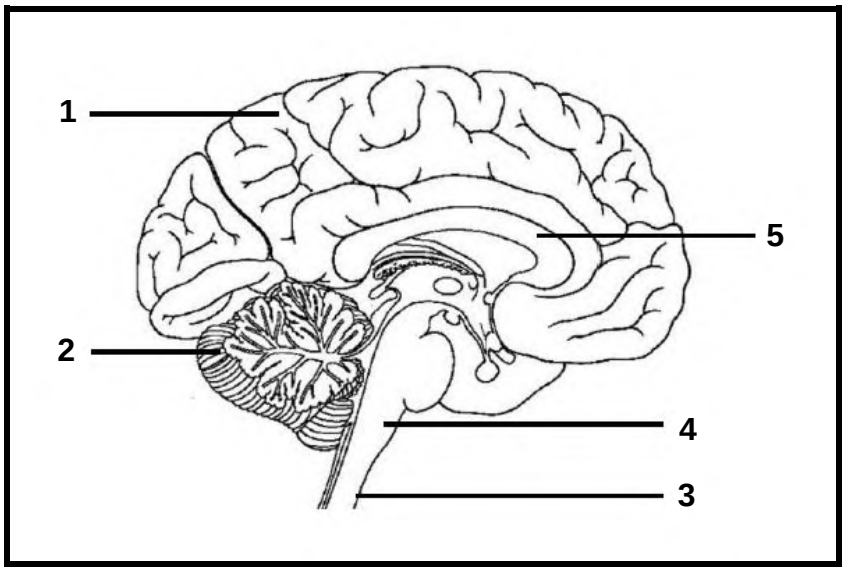
(i) DNA unwinds and unzips
(ii) Peptide bonds are formed
(iii) Thymine pairs with adenine on the template strands
(iv) tRNA brings specific amino acids to the ribosome
(v) mRNA molecule is formed

Which ONE of the following is the correct combination of events during translation?

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

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QUESTION 1.1.7 AND 1.1.8 ARE BASED ON THE DIAGRAM BELOW.



1.1.7 Which part controls balance and equilibrium?

A 1
B 2
C 4
D 5

1.1.8 Which one of the following is a possible symptom in a person whose part **4** is not functioning well?

A Irregular heart beats
B Memory loss
C Slow response to the stimulus
D Loss of sight

1.1.9 The list below are events during balance:

(i) Stimulates the cristae
(ii) Impulses are sent by the auditory nerve to the brain
(iii) The cerebellum sends impulses to the muscles to restore balance
(iv) The stimulus is converted to an impulse
(v) A change in speed/direction of movement

Which ONE of the following is a correct sequence of events?

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

(9 x 2) **(18)**

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 1.2.10) in the ANSWER BOOK.

1.2.1 All the genes that make up an organism

1.2.2 An inherited disorder where blood fails to clot properly

1.2.3 An alternative form of a gene at the same locus

1.2.4 The membrane that, together with the endometrium, forms the placenta

1.2.5 The structure in the head of a sperm containing digestive enzymes to penetrate the ovum

1.2.6 Nerves linking receptor and effector organs with the brain and spinal cord

1.2.7 The formation of gametes by meiosis

1.2.8 Hormone that is produced by corpus luteum to further thickens the endometrium

1.2.9 The part of the amniotic egg which stores waste

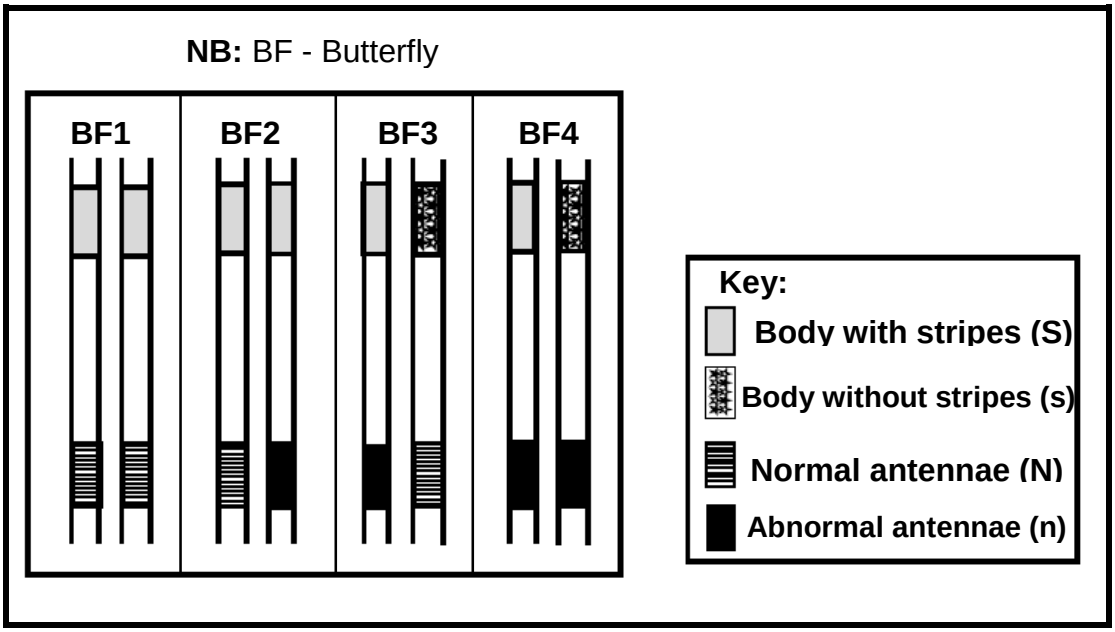
(9 x 1) **(9)**

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 1.3.5) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Condition affecting the lens of the eye	A: Astigmatism B: Cataract
1.3.2	Outer jelly-like layer of an ovum	A: Cytoplasm B: Shell
1.3.3	A disorder caused by the degeneration of the myelin sheath of motor neurons	A: Multiple sclerosis B: Alzheimer's disease
1.3.4	The innermost membrane surrounding the foetus	A: Amnion B: Cell membrane
1.3.5	The scientist who discovered the structure of the DNA molecule	A: James Watson B: Francis Crick

(5 x 2) **(10)**

1.4 The diagram below shows one pair of homologous chromosomes found in each of four butterflies. The alleles for antenna shape (normal or abnormal) and body pattern (with stripes or without stripes) are indicated on the chromosomes for each butterfly.



1.4.1 Write down the NUMBER only of a butterfly that is:

(a) Heterozygous for body pattern only. (1)

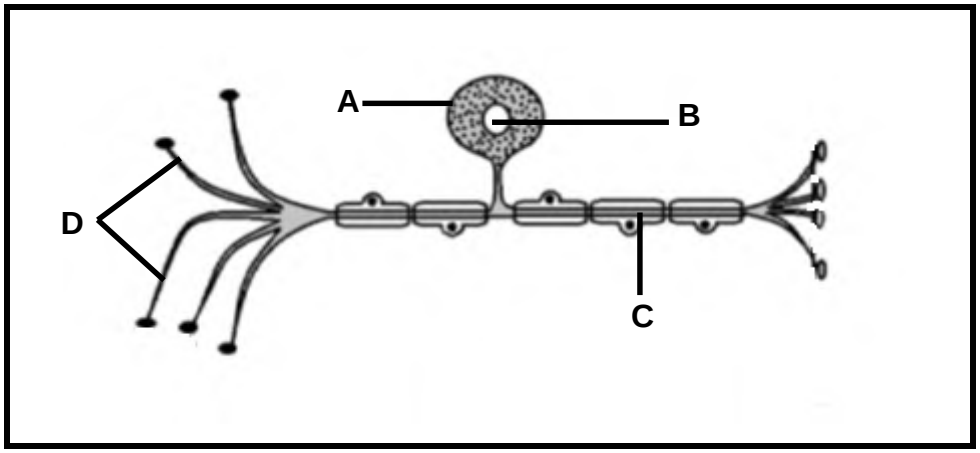
(b) Homozygous for both characteristics (1)

1.4.2 Write down the phenotype for butterfly **2**. (1)

1.4.3 What will be a phenotypic ratio of offsprings if buttefly **3** was crossed with a butterfly with the same genotype as butterfly **3**? (2)

1.4.4 Write down all possible gametes from butterfly **2**. (2)
(7)

1.5 Study the diagram of a neuron below.



1.5.1 Identify the type of neuron shown in the diagram above. (1)

1.5.2 Identify parts:

(a) **A** (1)

(b) **C** (1)

1.5.3 Give ONE function of:

(a) **B** (1)

(b) **C** (1)

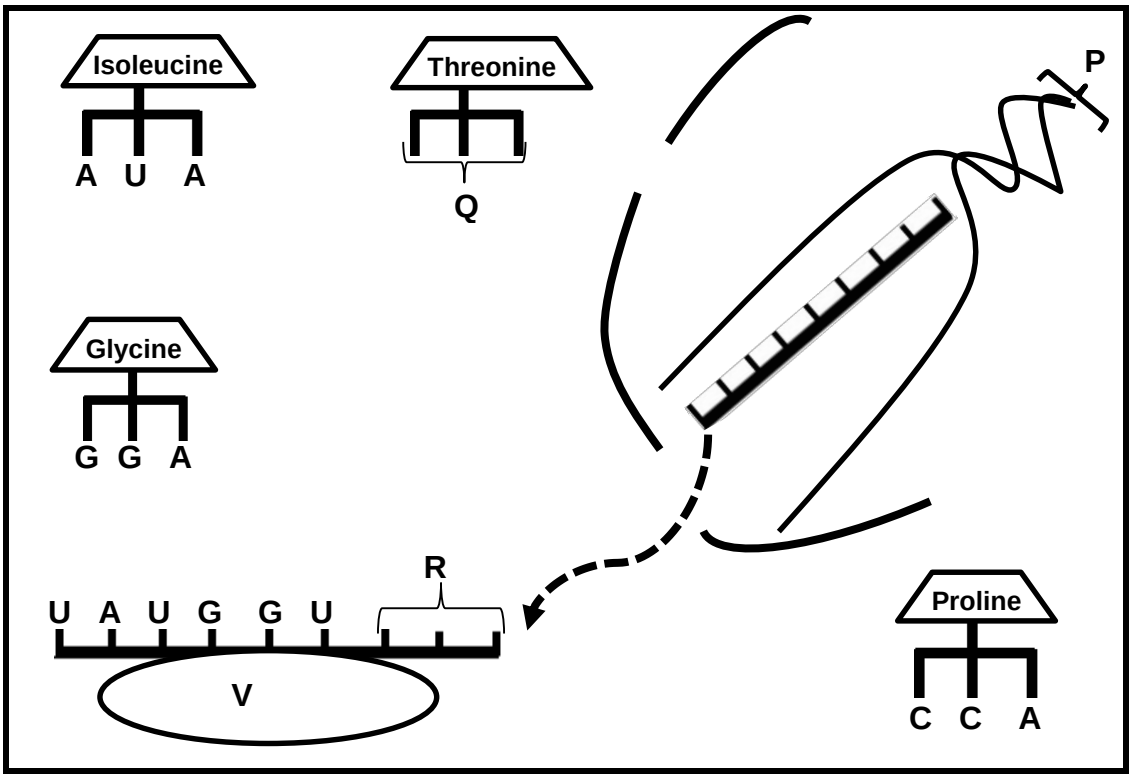
(c) **D** (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows protein synthesis.



2.1.1 Identify:

(a) Organelle **V** (1)

(b) Molecule **Q** (1)

2.1.2 Write down nitrogen bases for codon **R** if it codes for glycine. (1)

2.1.3 Write down the sequence of the first TWO amino acids (from left to right) which codes for molecule **Q**. (2)

2.1.4 Explain the effect on the protein formed, if all guanine (**G**) bases in molecule **Q** were replaced by cytosine (**C**) bases. (3)

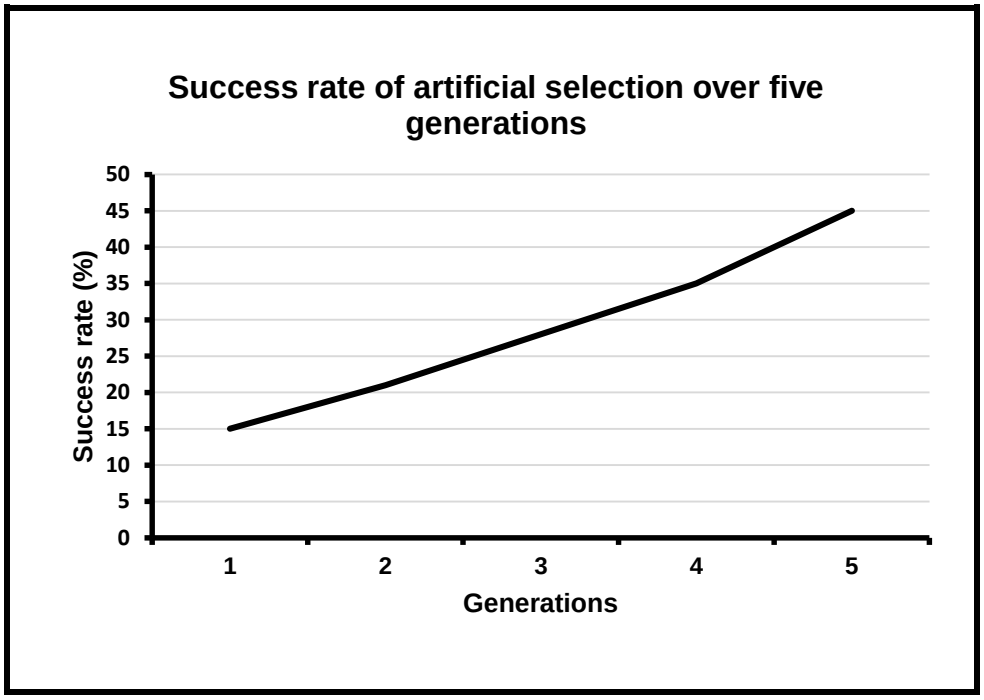
2.1.5 Tabulate TWO structural differences between molecule **P** and molecule **Q**. (5)

2.1.6 Describe the stage of protein synthesis which involves molecule **Q**. (6)
(19)

2.2 *Artificial selection* or selective breeding is the choosing of parent organisms with a known genotype to produce offspring with specific traits in quantities within a short space of time than in nature.

A farmer wanted to produce sheep that are good wool and meat producers. He performed the genetic modification and recorded the number of offspring that produced both good wool and meat.

The graph below shows the results of the investigation over five generations.



2.2.1 Identify the:

(a) Dependent variable (1)

(b) Independent variable (1)

2.2.2 What is the percentage success rate of generation 5? (1)

2.2.3 Explain ONE way in which the farmer could use the results to his advantage. (2)

2.2.4 State TWO ways he could have ensured validity in this experiment. (2)

2.2.5 Give a conclusion for this experiment. (2)

2.1.6 Give ONE reason why this investigation was carried over five generations. (1)
(10)

2.3 ***Auditory Processing Disorders*** occur when the brain has problems in processing the information, such as understanding speech.

Conductive Hearing Loss occurs when there is a problem with the Outer or Middle Ear which interferes with the passing sound to the Inner Ear.

Sensorineural Hearing Loss occurs when some parts of the ear are damaged or malfunctions so it is unable to accurately send the electrical information to the brain.

The table below shows the percentage of people who suffered from different types of hearing loss.

Type of hearing loss	**People suffering (%)**
Auditory processing	5
conductive	54
Sensorineural	6
Mixed	35
TOTAL	**100**

2.3.1 Name the part of the brain that is damaged if a person suffers from Auditory processing disorder. (1)

2.3.2 Name TWO parts of an ear that are most likely damaged in a person who has sensorineural hearing loss. (2)

2.3.3 Explain why conductive hearing loss may be temporal than other types of hearing loss. (2)

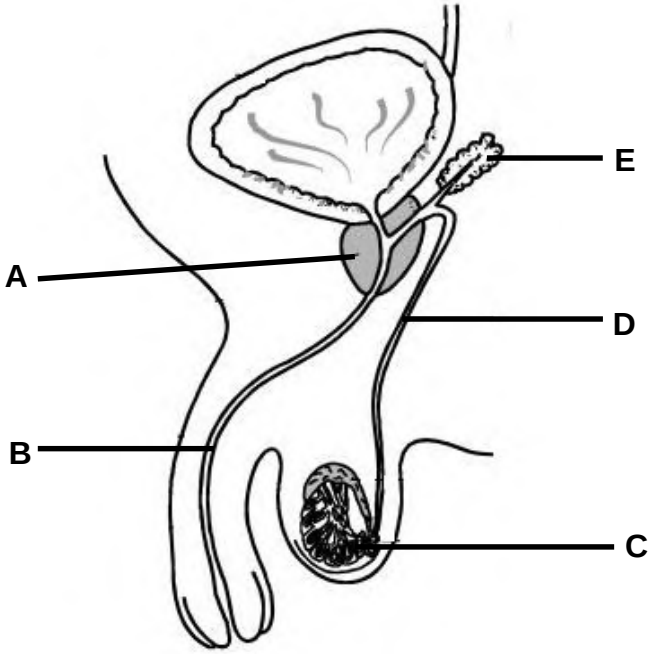
2.3.4 Draw a bar graph to represent the information in the table. (6)
(11)
[40]

QUESTION 3

3.1 Read the extract and study the diagram below.

An undescended testicle (testicle that hasn't moved into the scrotum).

An undescended testicle is common among baby boys born prematurely, born of smokers, alcohol drinking mother. The undescended testicle moves into the proper position on its own but if not, surgery can relocate the testicle into the scrotum. This may lead to infertility in men.



3.1.1 Identify parts:

(a) **C** (1)

(b) **E** (1)

3.1.2 Name TWO risk factors from the passage that might cause undescended testicle in male babies. (2)

3.1.3 State ONE function of part **B**. (1)

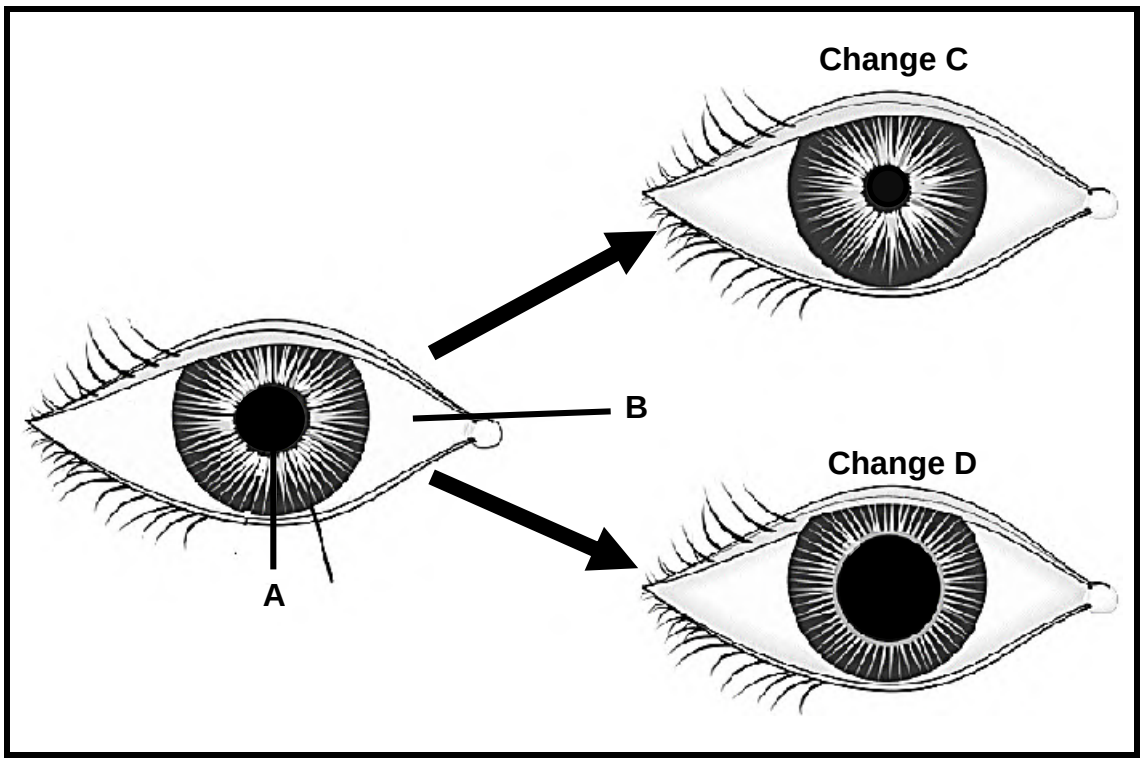
3.1.4 Explain how undescended testicle may lead to infertility in men. (3)

3.1.5 State TWO pieces of advice you would give to a pregnant woman to eliminate the risk of undescended testicle in their child. (2)

3.1.6 Explain the consequence if part **D** was surgically cut and tied. (2)

3.1.7 Describe the process by which sperms are formed. (5)
(17)

3.2 Study the diagram of a human eye.



3.2.1 Name the process illustrated in the diagram. (1)

3.2.2 Identify parts:

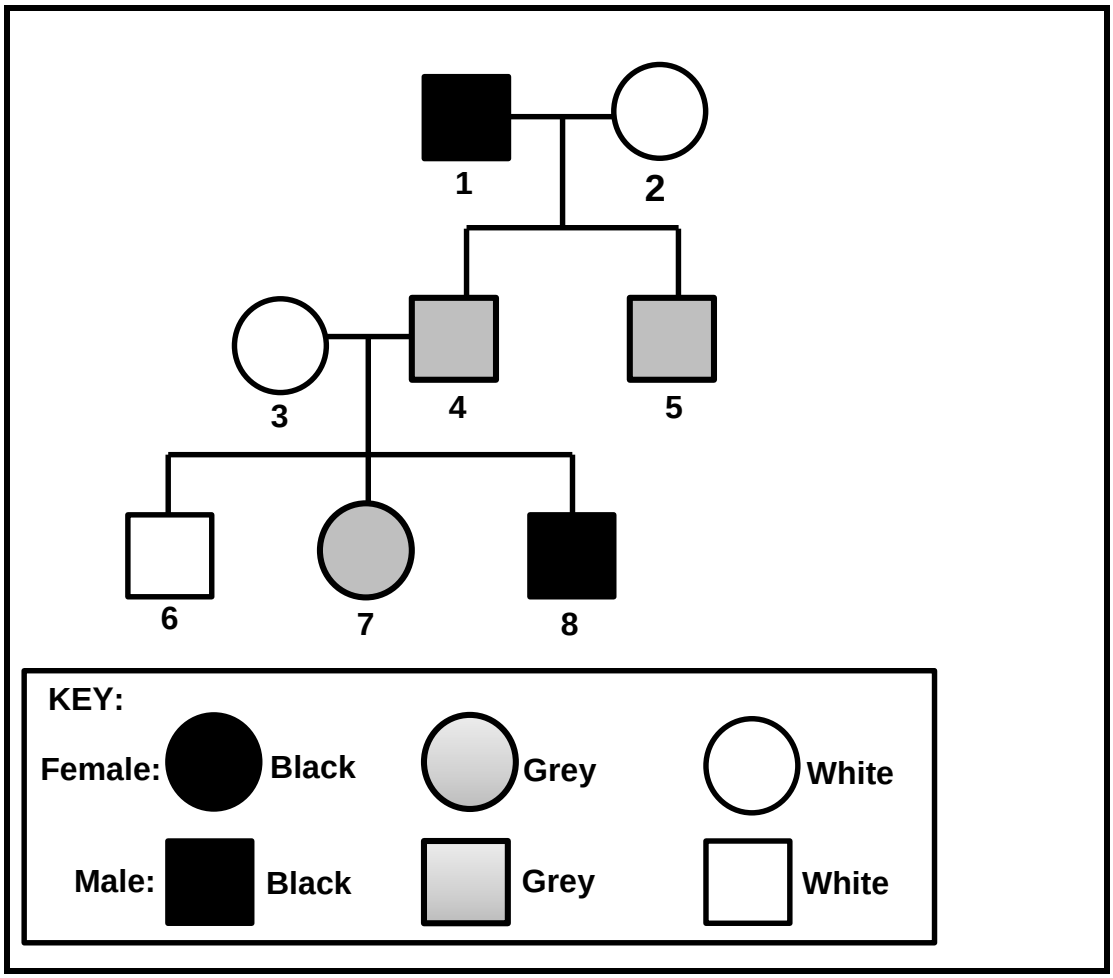
(a) **A** (1)

(b) **B** (1)

3.2.3 Which change (**C** or **D**) occurs in the eye when you are watching a television and suddenly the power goes out during the night? (1)

3.2.4 Describe change **D**. (5)
(9)

3.3 The following diagram shows the inheritance of fur colour in squirrels. Black colour is controlled by allele (**B**) and white colour (**W**)



3.3.1 From the pedigree diagram above, how many individuals:

(a) Are males with black fur colour (1)

(b) Are heterozygous for fur colour (1)

3.3.2 Name the type of dominance shown in the pedigree diagram. (1)

3.3.3 Explain why grey colour offspring was produced when mating individual **1** and **2**. (3)

3.3.4 Identify the phenotype for individual **2**. (1)

3.3.5 How many generations are represented in this diagram? (1)

3.3.6 Give the genotype of individual **7**. (1)

3.3.7 Do a genetic cross between individual **3** and **4**. (6)
(15)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe how meiosis leads to genetic variation and describe the role of meiosis in oogenesis. Also describe how mutation results in Down syndrome.

Content: (17)
Synthesis: (3)
(20)

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

TOTAL SECTION C: 20
GRAND TOTAL: 150

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Education

KwaZulu-Natal Department of Education

LIFE SCIENCES

COMMON TEST

MEMORANDUM - JUNE 2020

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 150

This memorandum consists of 8 pages.

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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.

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SECTION A

QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	B✓✓		
	1.1.3	C✓✓		
	1.1.4	D✓✓		
	1.1.5	C✓✓		
	1.1.6	A✓✓		
	1.1.7	B✓✓		
	1.1.8	A✓✓		
	1.1.9	B✓✓	(9 x 2)	**(18)**
1.2	1.2.1	Genome✓		
	1.2.2	Haemophilia✓		
	1.2.3	Alleles✓		
	1.2.4	Chorion✓		
	1.2.5	Acrosome✓		
	1.2.6	Peripheral nerves✓		
	1.2.7	Gametogenesis✓		
	1.2.8	Progesterone✓		
	1.2.9	Allantois✓		**(9)**
1.3	1.3.1	B only✓✓		(2)
	1.3.2	None✓✓		(2)
	1.3.3	A only✓✓		(2)
	1.3.4	A only✓✓		(2)
	1.3.5	Both A and B✓✓		(2) **(10)**
1.4	1.4.1	(a) 4✓		(1)
		(b) 1✓		(1)
	1.4.2	Striped body with normal antennae✓		(1)
	1.4.3	9 Striped with normal antennae: 3 Striped with abnormal antennae: 3 No striped with normal antennae: 1 No stripes and abnormal antennae✓✓/9:3:3:1		(2)
	1.4.4	- SN✓ - Sn✓		(2) **(7)**

1.5 1.5.1 Sensory neuron✓ (1)

1.5.2 (a) Cell body✓ (1)

(b) Axon✓ (1)

1.5.3 (a) Controls functioning of the neuron✓ (1)

(b) Carry impulses away from the cell body✓ (1)

(c) Transmit impulses towards the cell body✓ (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 (a) Ribosome ✓ (1)

(b) tRNA✓ (1)

2.1.2 CCU✓ (1)

2.1.3 Isolecine,✓ proline,✓ (2)

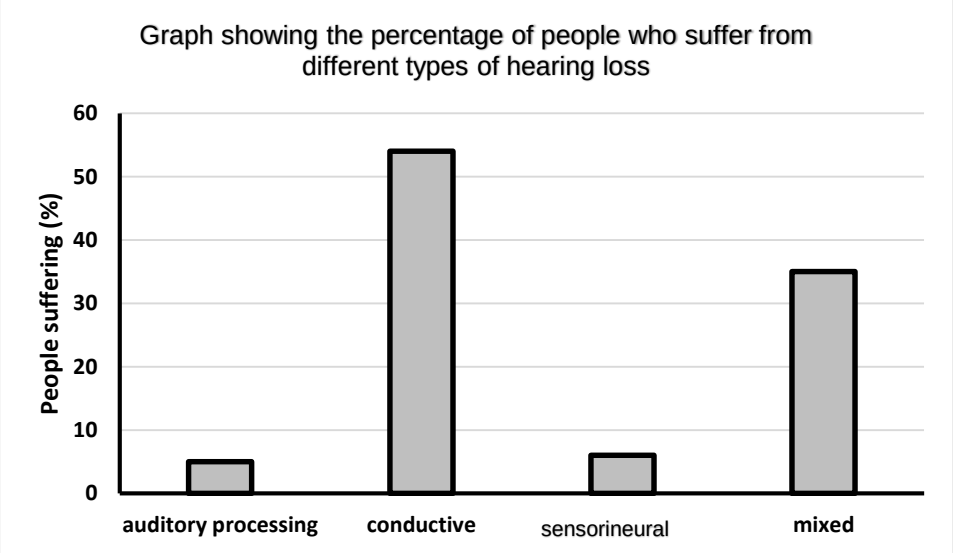
2.1.4 - tRNA will change its bases sequence✓
- Proline would be replaced by glycine✓
- leading to the formation of a different protein✓ (3)

2.1.5 ✓

Molecule P/DNA	**Molecule Q/ mRNA**
Double stranded	Single stranded ✓
Has thymine	Has uracil ✓
Long molecule	Short molecule ✓

(1 + 4) (5)

2.1.6 Translation ✓
- Each t-RNA picks up a specific amino acid ✓
- When the anticodon on the tRNA ✓
- Matches the codon of the mRNA ✓
- Then tRNA brings the required amino acid to the ribosome ✓
- Amino acids become attached by peptide bonds ✓
- to form required protein ✓ Any (6)
(19)

2.2	2.2.1	(a) Success rate✓	(1)
		(b) Genrations✓	(1)
	2.2.2	45✓	(1)
	2.2.3	- He would produce sheep with good wool✓ - and also good meat✓	(2)
	2.2.4.	- Use the same species of sheep✓ - Use sheep of the same age✓	(2)
	2.2.5	The amount of wool and meat production increases from generation to generation due to artificial selection✓✓	(2)
	2.2.6	To increase reliability✓	(1)
			(10)
2.3	2.3.1	Cerebrum✓	(1)
	2.3.2	- cochlea✓ - auditory nerve✓	(2)
	2.3.3	- Ear wax that blocks the ear can be removed✓ - Structures that conduct hearing can heal over time✓	(2)
	2.3.4		(6)
			(11)
			[40]

QUESTION 3

3.1			
3.1.1	(a) Epididymis✓		(1)
	(b) Prostate gland✓		(1)
3.1.2	- Mothers who smoke while pregnant✓ - Mothers who drink alcohol while pregnant✓ - Premature birth✓	Any	(2)
3.1.3	Transports semen to the exterior✓		(1)
3.1.4	-The testicle will remain inside the body✓ - and receiving temperature equal to body✓/high temperature - which will affect sperm cells✓ - leading to a decreased sperm count✓	Any	(3)
3.1.5	- Do not smoke while pregnant✓ - Do not drink alcohol while pregnant✓		(2)
3.1.6	- The passage for sperm to reach the urethra will be blocked,✓ - therefore no sperm will enter the urethra✓ - There will be no sperm present in the semen✓	Any	(2)
3.1.7	- Spermatogenesis✓ - Under the influence of testosterone✓ - Diploid cells✓ - in seminiferous tubules✓/testis - undergo meiosis✓ - to form haploid sperm cells✓	Any	(5)
3.2			**(17)**
3.2.1	Pupillary mechanism✓		(1)
3.2.2	(a) Pupil✓		(1)
	(b) Sclera✓		(1)
	Change D✓		(1)
3.2.3	- Circular muscles relax✓		(1)
3.2.4	- Radial muscles contract✓ - Pupil dilates✓ - allowing more light to enter the eye✓		(5)
			(9)

3.3 (a) 2✓ (1)

3.3.1 (b) 4✓ (1)

3.3.2 Incomplete dominance✓ (1)

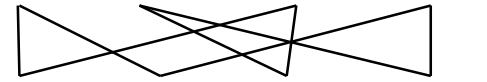
3.3.3 - When the black and white squirrels were mated, they produced a grey offspring✓
- which is a third phenotype✓
- since alleles for black and white are neither dominant nor recessive (3)

3.3.4 White✓ (1)

3.3.5 3 ✓ (1)

3.3.6 BW✓ (1)

3.3.7 **P_1** Phenotype white female x grey male✓
Genotype WW x BW✓
Meiosis
Gametes W, W x B W✓ (3)
Fertilisation



F_1 Genotype BW WW BW , WW✓

Phenotype 2 grey; 2 white
P_1 and F_1✓
Meiosis and fertilisation✓

OR

P_1 Phenotype white female x grey male✓
Genotype WW x BW✓

Meiosis

Fertilisation

F_1

Gametes	B	W
W	BW	WW
W	BW	WW

1 mark for correct gametes
1 mark for correct genotypes

Phenotype 2 white; 2 grey✓

P_1 and F_1✓
Meiosis and fertilisation✓ (6) (6)

(15) (9)
[40]

TOTAL SECTION B: 80

SECTION C
QUESTION 4

Genetic variation (P)
Prophase I✓
- DNA untangles to form visible chromosomes✓
- Nucleolus and nuclear membrane disappears✓.
- Homologous chromosomes come together✓
- forming a homologous pair✓.
- Two non-sister chromatids of a homologous pair overlap✓
- forming a point called chiasma✓
- at which genetic material is exchanged✓
- during a process called crossing-over✓. (Any 6)

Metaphase I✓(M)
- Random arrangement of chromosomes occurs✓
- as they line in the equator in pairs✓
- following no pattern✓
- Chromosomes are held by spindle fibres✓ (Any 2) (8)

Role of meiosis in oogenesis (R)
- Diploid cell
- inside the follicles/ovary
- enlarges and undergoes meiosis
- Four cells are produced
- Only one survives to form a mature, haploid ovum Any (4)

Down syndrome (D)
- During anaphase I✓/II
- Chromosomes/chromatid on pair 21✓
- may fail to separate✓/non-disjunction
- resulting in a gamete with and extra chromosome✓ on pair 21
- when this gamete fertilises with a normal gamete✓/ with 23 chromosomes
- it will result in a zygote with 47 chromosomes✓
- leading to Down syndrome Any (5)

Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay
Only information about: - Genetic variation - Role of meiosis in oogenesis - Down syndrome - No irrelevant information is given.	Information about: - Genetic variation - Role of meiosis in oogenesis - Down syndrome	- Genetic variation 6/8 - Role of meiosis in oogenesis 2/4 - Down syndrome 3/5
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150