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KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES

COMMON TEST

JUNE 2022

MARKS: 150

TIME: $2^{1}/_{2}$ hours

N.B. This question paper consists of 16 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 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

1.1.1 An RNA nucleotide consists of a …

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

1.1.2 Which ONE of the following involves the development of the young inside the body of the mother and where it is nourished by the yolk?

A Ovipary
B Vivipary
C Ovovivipary
D Altricial

1.1.3 Below is a list of terms relating to reproductive strategies:

(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?

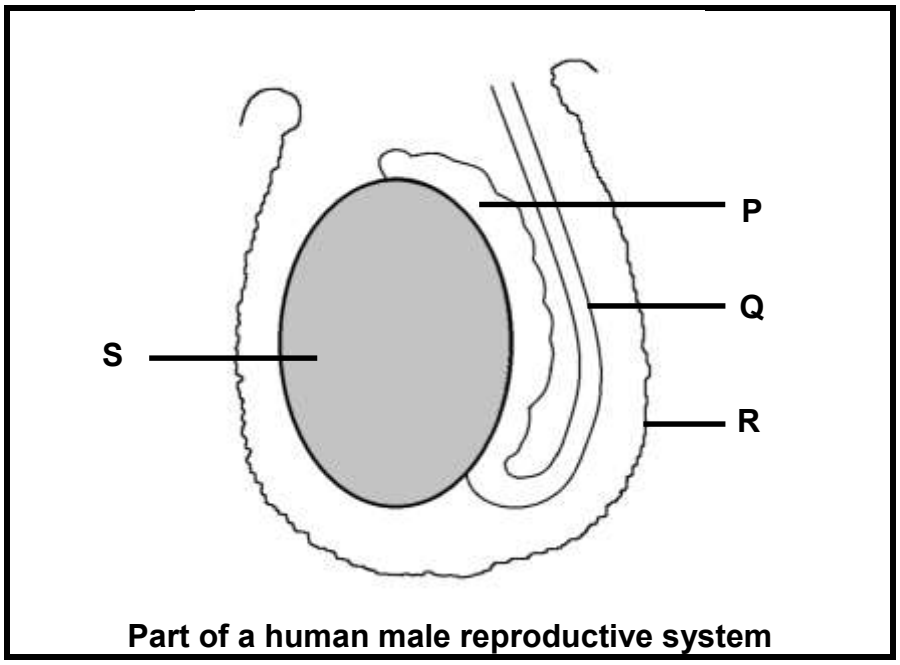
A (i), (ii), (iii) and (iv)
B (i), (iii) and (iv) only
C (ii), (iii) and (iv) only
D (i), (ii) and (iii) only



1.1.4 Internal fertilisation is the fusion of …

A a haploid male gamete with a haploid female gamete inside the body of a female.
B a diploid male gamete and a haploid female gamete inside the body of a female.
C A haploid male gamete with a diploid female gamete inside the body of the female.
D A haploid male gamete with a female somatic/body cell inside the body of the female.

1.1.5 The diagram below shows part of the human male reproductive system.



Part of a human male reproductive system

Which part(s) would lead to infertility if it was blocked?

A **P** and **Q**
B **Q** only
C **P** and **S**
D **Q** and **R**

1.1.6 Which ONE of the following is a possible consequence if testis did not hang outside the body of a human male?

A Sperm cells would be over active due to high temperature within the body.
B High temperature would lead to poor quality, fewer sperms produced
C Body temperature will increase testosterone production
D High temperature would increase the rate of sperm production

1.1.7 The part of a male reproductive system where sperm and urine pass is known as the …

A ejaculatory duct.
B ureter.
C urethra.
D vas diferens.

1.1.8 Below is a list of steps involved in protein synthesis

(i) The coding part of DNA unwinds and unzips
(ii) Peptide bonds are formed
(iii) Thymine nucleotide pairs off with adenine nucleotide on the template strands
(iv) One strand act as a template strand
(v) mRNA molecule is formed

Which ONE of the following is the correct sequence and combination of events during transcription?

A (i) → (ii) → (iii) → (v)
B (v) → (i) → (ii)
C (i) → (iv) → (v)
D (i) → (iii) → (iv) → (v)

1.1.9 The process whereby the embryo attaches itself to the wall of the uterus is called …

A menstruation.
B fertilisation.
C gestation.
D implantation.

1.1.10 During which phase of meiosis do homologous chromosome pairs separate?

A Metaphase I
B Anaphase I
C Anaphase II
D Telophase II

(10 x 2) **(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 to 1.2.9) in the ANSWER BOOK.

1.2.1 The reproductive strategy involving the laying of eggs

1.2.2 A condition of the cell where there is only one set of chromosomes

1.2.3 The building block/monomer of a nucleic acid

1.2.4 The natural shape of the DNA molecule

1.2.5 The hormone that stimulates milk production

1.2.6 The maintenance of a constant internal environment in the body within narrow limits

1.2.7 An increase in the diameter of blood vessels which increases blood flow

1.2.8 The process where DNA molecule makes an identical copy of itself

1.2.9 Structure of the amniotic egg that collects the embryo's nitrogenous waste 9 x 1 **(9)**

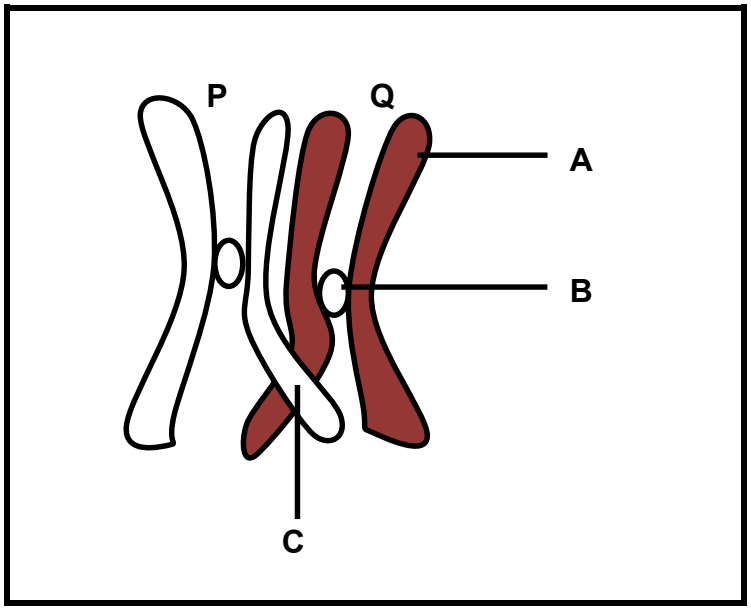
1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Chromosomes arrange at the equator in pairs	A: B:	Metaphase I Anaphase I
1.3.2	In a DNA molecule	A: B:	Cytosine pairs with adenine. Guanine pairs with thymine.
1.3.3	Location of DNA.	A: B:	nucleus mitochondria

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



1.4 The diagram below shows a part of a process during meiosis.



1.4.1 Identify parts:

(a) **A** (1)

(b) **B** (1)

1.4.2 Name the process taking place in the diagram above. (1)

1.4.3 State the phase of meiosis during which the process mentioned in QUESTION 1.4.2 occurs. (1)

1.4.4 Name point **C**. (1)

1.4.5 Give ONE significance of point **C**. (1)

1.4.6 Give the collective name for chromosomes **P** and **Q** (1)
(7)

1.5 In Chartreux cats the allele for purple eyes (**P**) is dominant over the allele for black eyes (**p**). The allele for rough fur (**R**) is dominant over the allele for smooth fur (**r**).

Cat A, heterozygous for both eye colour and fur texture, was crossed with cat B, which had smooth fur with black eyes.

1.5.1 Give the genotype of:

(a) Cat **A** (1)

(b) Cat **B** (1)

1.5.2 Give ALL the possible genotypes of the gametes of cat **A**. (2)

1.5.3 State the phenotype of an offspring having the genotype:

(a) ppRr (1)

(b) PpRr (1)

1.5.4 When cat **B** was crossed with cat **C**, all the offspring had purple eye and rough fur.

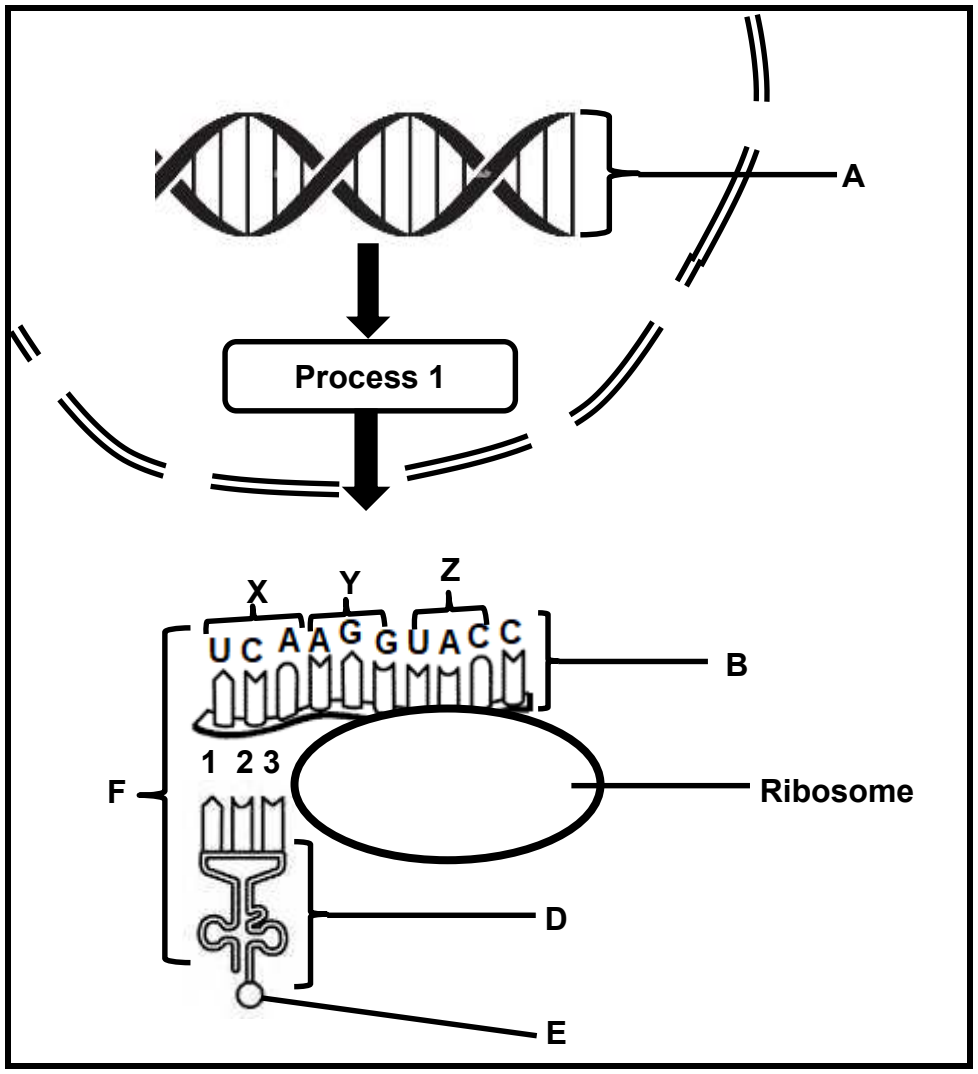
Use this information and write down the genotype of cat **C**. (2)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows part of the process of protein synthesis.



2.1.1 Identify:

(a) The collective name for nitrogen base triplets of molecule **D**. (1)

(b) Monomer **E** (1)

(c) Process **F** (1)

2.1.2 Explain the significance of molecule **A** in protein synthesis. (1)

2.1.3 Identify nitrogen bases **1** and **2** respectively as found on molecule **D**. (2)

2.1.4 Describe the process **1** which formed molecule **B**. (5)

2.1.5 The table below shows the amino acids that correspond with different DNA codes.

AMINO ACID	DNA CODE
Arginine	ATG
Methionine	TCC
Glycine	AGT

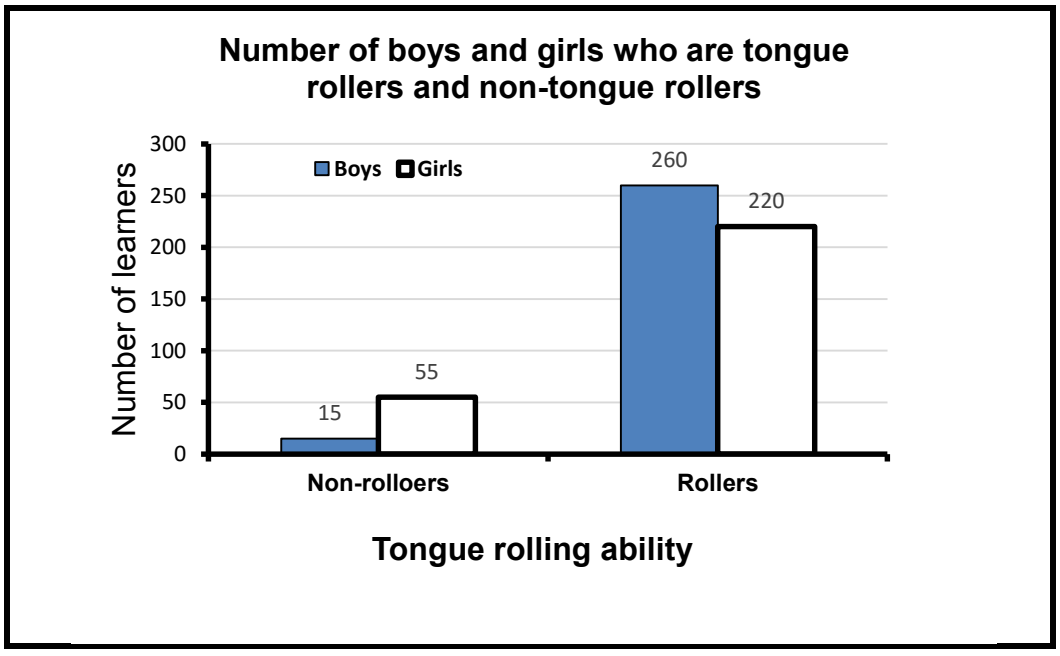
Write down the correct sequence of amino acids coded for by codons **X**, **Y** and **Z** respectively. (3)
(14)

2.2 A group of grade 12 learners conducted an investigation to determine the frequency of tongue rolling ability among boys and girls in their school.

The procedure was as followed:

- The asked 550 learners to participate
- They divided the group into 275 boys and 275 girls
- They asked them to roll their tongues
- They counted and recorded the number of rollers and non-rollers
- Same person counted the rollers and non-rollers

The results of the learners' investigation are shown in the graph below.



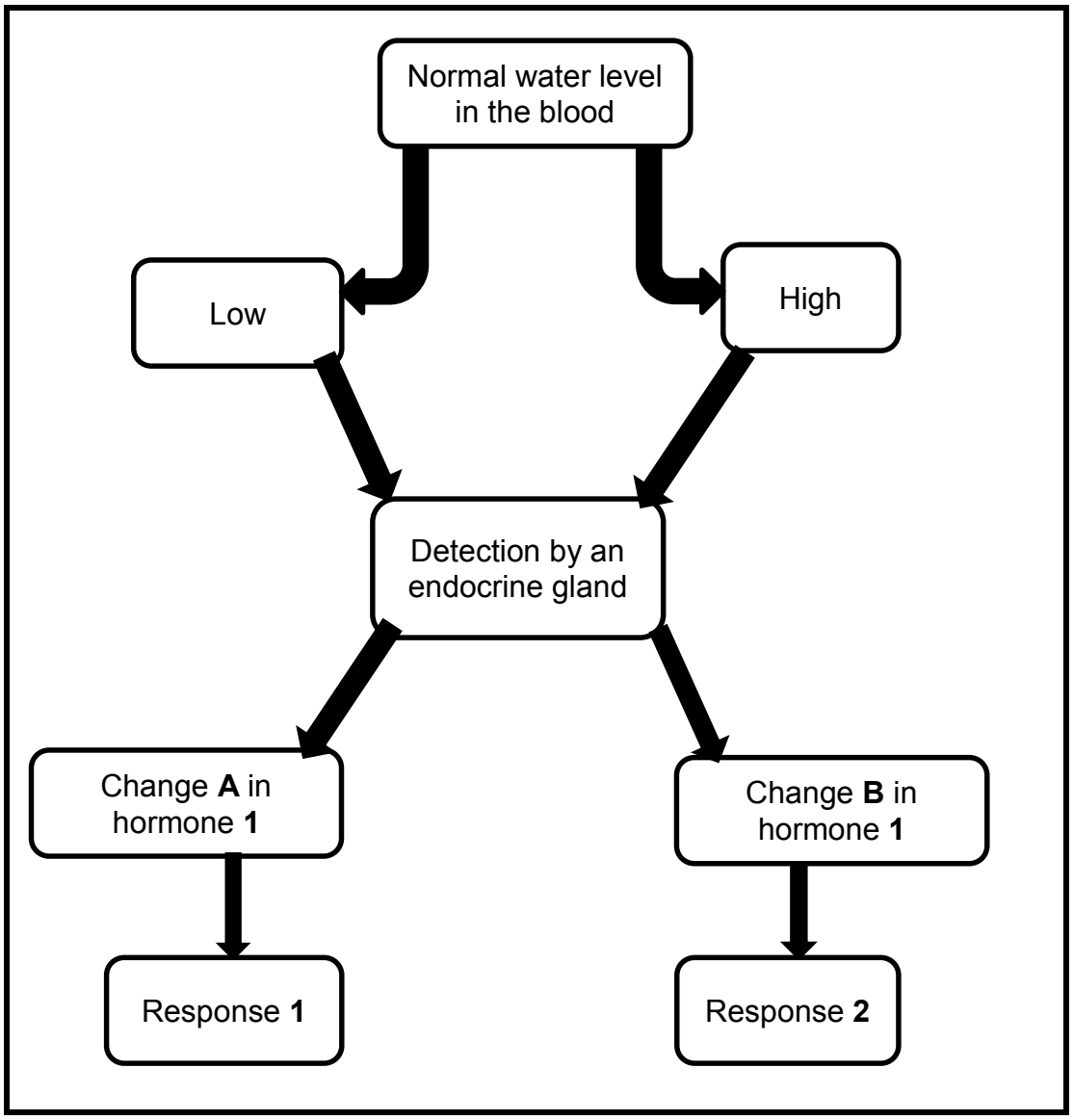
2.2.1 State THREE steps that must be considered when planning this investigation. (3)

2.2.2 Describe TWO ways by which the learners ensured validity of their investigation. (2)

2.2.3 State why the learners used 550 learners and not less. (1)

2.2.4 Use the data in the graph to draw a table that shows the results they obtained. (4)
(10)

2.3 The flow diagram below showing the response of an endocrine gland to changes in the level of water in the blood.



2.3.1 Name the endocrine gland that responds to changes in water level in the blood. (1)

2.3.2 Identify hormone **1**. (1)

2.3.3 State change **B** as shown in the flow diagram. (1)

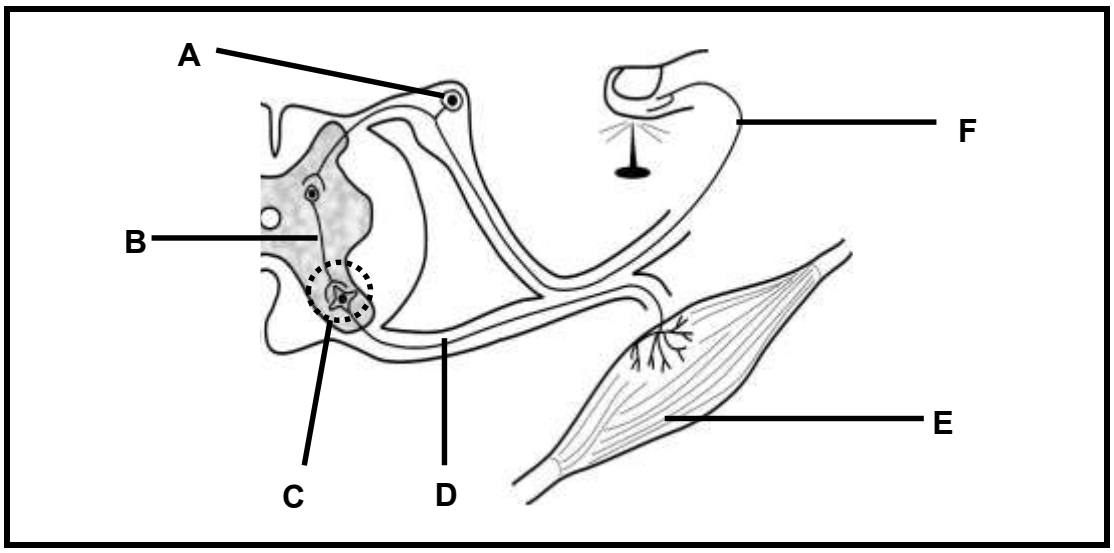
2.3.4 Which response (**1** or **2**) will occur after drinking a lot of water? (1)

2.3.5 Describe how response **1** occurs. (5)
(9)



2.4 Describe how errors that occur during meiosis may lead to Down syndrome. **(5)**

2.5 The diagram below shows a reflex arc.



2.5.1 Identify:

(a) Part **A** (1)

(b) Neuron **F** (1)

(c) Structure **E** (1)

2.5.2 State ONE function of each of the following:

(a) Neuron **B** (1)

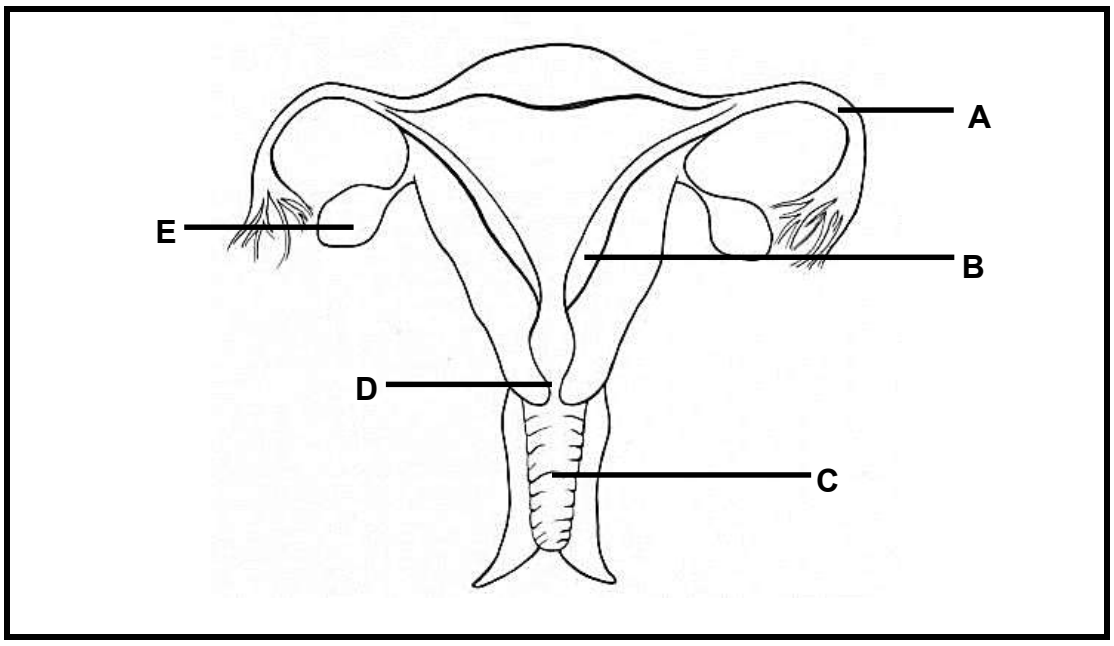
(b) Microscopic gap **C**. (1)

2.5.3 Using the LETTERS **B**, **D** and **F** only, give the correct sequence in which the neurons are involved from the time a stimulus is received until a response takes place. (2)
(7)

2.6 Describe the negative feedback that occurs when thyroxin level is high in the blood. **(5)**
[50]

QUESTION 3

3.1 The diagram below shows part of the human reproductive system.



3.1.1 Identify parts:

(a) **C** (1)

(b) **D** (1)

3.1.2 Name the structure/ organ formed by part **B** from implantation until birth. (1)

3.1.3 Explain the consequence if part **A** was surgically cut and tied. (3)

3.1.4 Describe oogenesis as it will occur in part **E**. (4)
(10)

3.2 Read the extract below.

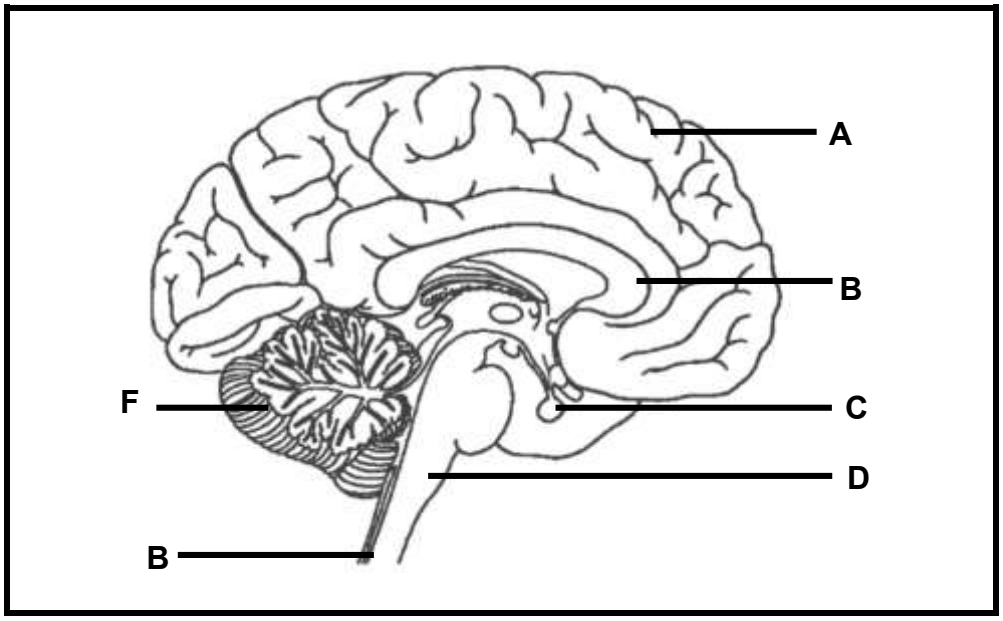
> *Menorrhagia* is a medical term for menstrual periods with abnormally heavy or prolonged bleeding. Although heavy menstrual bleeding is a common concern, most women don't experience blood loss severe enough to be defined as menorrhagia.
>
> Soaking through one or more sanitary pads every hour for several consecutive hours, bleeding for longer than a week, restricting daily activities due to heavy menstrual flow are some of the symptoms. One of the causes is when your ovaries don't release an egg during a menstrual cycle, your body doesn't produce the hormone progesterone, as it would during a normal menstrual cycle.

3.2.1 Give TWO symptoms of menorrhagia from the passage. (2)

3.2.2 Explain why this condition causes non-production of progesterone. (2)

3.2.3 Explain why the symptoms mentioned in the passage may lead to tiredness in a female with menorrhagia. (3)
(7)

3.3 The diagram below shows part of a human brain.



3.3.1 Identify parts:

(a) **B** (1)

(b) **C** (1)

(c) **F** (1)

3.3.2 Explain why damage to part **D** could lead to immediate death. (2)

3.3.3 State TWO functions of part **A**. (2)

3.3.4 Write down the LETTER and the NAME of the part that is a centre for reflex action. (2)
(9)

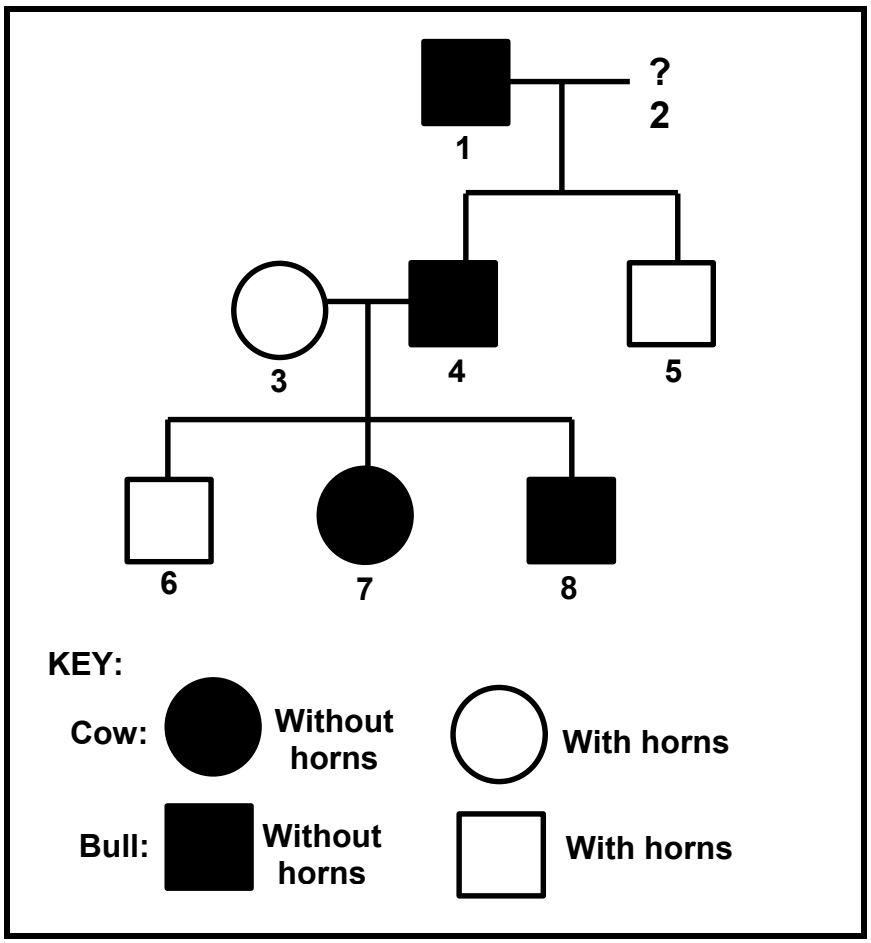
3.4 Describe the role of maculae in maintaining balance. **(4)**

3.5 Dronan has been sitting in a dark room for over an hour when lights came on.

3.5.1 Name photoreceptors in the eye that are sensitive to dim light. (1)

3.5.2 Describe pupillary mechanism under bright light. (4)
(5)

3.6 In beef cattle of European ancestry, the trait of having no horns or having horns is determined by one pair of genes. The gene for having no horns (**P**) is dominant to the gene for having horns (**p**). The pedigree diagram bellow shows horn inheritance among beef cattle.



3.6.1 From the pedigree diagram above, how many:

(a) Bulls without horns? (1)

(b) Individuals are homozygous? (1)

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

3.6.3 Explain your answer to QUESTION 3.6.2 (2)

3.6.4 Identify the possible genotype(s) for individual **2**. (2)

3.6.5 Write down the NUMBER of the individual that is heterozygous in the 2nd generation. (1)

3.6.6 Represent a genetic cross between individual **5** and **7** to show the percentage chance of producing a calf with horns. (7)

(15)

[50]

TOTAL SECTION B: 100

GRAND TOTAL: 150

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FINAL!!!



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EDUCATION
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GRADE 12

LIFE SCIENCES

COMMON TEST

MEMORANDUM - JUNE 2022

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	C✓✓		
	1.1.3	C✓✓		
	1.1.4	A✓✓		
	1.1.5	A✓✓/C		
	1.1.6	B✓✓		
	1.1.7	C✓✓		
	1.1.8	C✓✓		
	1.1.9	D✓✓		
	1.1.10	B✓✓	(10 x 2)	**(20)**

1.2	1.2.1	Ovipary✓/Oviparous	
	1.2.2	Haploid✓	
	1.2.3	Nucleotide✓	
	1.2.4	Double helix✓	
	1.2.5	Prolactin✓	
	1.2.6	Homeostasis✓	
	1.2.7	Vasodilation✓	
	1.2.8	Replication✓	
	1.2.9	Allantois✓	**(9)**
1.3	1.3.1	A only✓✓	(2)
	1.3.2	None✓✓	(2)
	1.3.3	Both A and B✓✓	(2)
			(6)
1.4	1.4.1	(a) Chromatid✓	(1)
		(b) Centromere✓	(1)
	1.4.2	Crossing-over✓	(1)
	1.4.3	Prophase I✓	(1)
	1.4.4	Chiasma✓	(1)
	1.4.5	It is where genetic material is exchanged✓/point of overlap/contact/attachment of chromatids	(1)
	1.4.6	Homologous pair✓	(1)
			(7)

1.5 1.5.1 (a) PpRr✓ (1)

(b) pprr✓ (1)

1.5.2 PR, Pr, pR, pr✓✓ **(2 Marks or nothing/No part marks)** (2)

1.5.3 (a) Black eyes with rough fur✓ (1)

(b) Purple eyes with rough fur✓ (1)

1.5.4 PPRR✓✓ (2)
(8)

SECTION B

QUESTION 2

2.1 2.1.1 (a) Anti-codon✓ (1)

(b) Amino acid✓ (1)

(c) Translation✓ (1)

2.1.2 - Carries a coded message✓/Formation of mRNA for the formation of a specific protein (1)

2.1.3 Adenine✓/A and Guanine✓/G (2)

2.1.4 - 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 5 (5)

2.1.5 Glycine✓ Methionine✓ Arginine✓ **(In this order)** (3)
(14)

2.2 2.2.1 - Decide on the sample size✓
- Decide on the sample selection✓
- Get permission from the school✓ to conduct the investigation
- Decide on the appropriate time/day/venue to conduct the investigation✓
- Decide on how to record results of the investigation✓
- Ask for permission from the participants✓

(Mark the FIRST THREE only) any 3 (3)

2.2.2 - Same person counted✓
- Equal number of boys and girls✓ (2)

2.2.3 To ensure/increase the reliability✓ of the investigation (1)

2.2.4

	Boys	Girls
Tongue rollers	260	220
Non-tongue rollers	15	55

(4)
(10)

Marking Criteria:

Columns heading(**C**)	1
Rows heading (**R**)	1
Data correct in the table (**T**)	1: 1-3 correct 2: All correct

2.3 2.3.1 Pituitary✓ gland/Hypophysis (1)

2.3.2 ADH✓/Anti-diuretic hormone (1)

2.3.3 Hormone 1✓/ADH decreases (1)



2.3.4 2✓ (1)

2.3.5
- Increase in ADH✓
- Increases permeability of the distal convoluted tube✓/nephron
- More water leaves the nephron✓
- Into the medulla✓/surrounding tissue fluid
- And eventually enters the blood✓
- Which increases water level in the blood✓ back to normal. (5)
(9)

2.4
- During anaphase✓ I/II
- Chromosomes/chromatid on pair 21✓
- may fail to separate✓/non-disjunction occurs
- resulting in a gamete with an 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✓/3 chromosomes in 21
- leading to Down syndrome Any 5 **(5)**

2.5 2.5.1 (a) Cell body✓ (1)

(b) Sensory✓/afferent neuron (1)

(c) Effector✓/muscle (1)

2.5.2 (a) Transmit impulses from/connects the sensory neuron to the motor neuron✓. (1)

(b) Ensures one directional flow of impulses✓. (1)

2.5.3 (F, B, D) ✓✓ **In this order!** (2)
(7)

2.6 - Pituitary gland is stimulated✓
- to secrete less TSH✓
- which stimulates the thyroid gland✓
- to secrete less thyroxin✓ into the blood
- therefore thyroxin level decreases✓
- back to normal✓ Any 5 **(5)**

[50]

QUESTION 3

3.1 3.1.1 (a) Vagina✓ (1)

(b) Cervix✓ (1)

3.1.2 Placenta✓ (1)

3.1.3 - The other fallopian tube✓
- will allow the sperm to meet the ovum✓
- therefore fertilisation will still occur✓/pregnancy can occur

OR

- sperm cell will not reach the ovum✓
- fertilisation will not occur✓
- resulting in infertility✓. (3)

3.1.4 - Diploid cells in the ovary undergo mitosis✓
- to form numerous follicles✓.
- At the onset of puberty✓
- and under the influence of FSH✓,
- 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 4 (4)

(10)

3.2 3.2.1 - bleeding for longer than a week✓
- heavy menstrual flow✓ (2)

(Mark the FIRST TWO only)

3.2.2 - If ovulation does not occur✓/ovum is not released
- corpus luteum will not be formed✓ (2)

3.2.3 - More blood will be lost✓
- within a short space of time✓
- leading to poor oxygen supply✓
- decreasing the rate of respiration✓
- less energy will be available✓. (3)

(7)

3.3 3.3.1 (a) No answer

(b) Pituitary gland✓ (1)

(c) Cerebellum✓ (1)

3.3.2
- Breathing and heartbeat will stop✓
- Causing lack of oxygen to the cells✓ (2)

3.3.3
- Controls voluntary actions✓
- Interprets sensations✓
- Responsible for higher thought processes✓ e.g. memory, judgement.

(Mark the FIRST TWO only) Any 2 (2)

3.3.4 No answer **(6)**

3.4
- Change in position of a head✓
- causes the endolymph to move✓
- which stimulates maculae✓ in the sacculus and utriculus
- Maculae converts the stimulus into an impulse✓
- which travels via the auditory nerve✓
- to the cerebellum✓
- Cerebellum sends impulses to the skeletal muscles✓
- to restore balance✓

Any 4 **(4)**

3.5 3.5.1 Rods✓ (1)

3.5.2
- Circular muscles contract✓
- Radial muscles relax✓
- Pupil constrict✓
- Less light enters the eye✓
- Objects are seen clearly✓

Any 4 (4)
(5)

3.6 3.6.1 (a) 3✓ (1)

(b) 3✓ (1)

3.6.2 Complete dominance✓ (1)

3.6.3
- When two different alleles are inherited✓
- The dominant allele controls the phenotype✓
- Masking over the effect of the recessive allele✓

Any 2 (2)

3.6.4 Pp✓and pp✓ (2)

3.6.5 4✓ (1)

3.6.6

P1 Phenotype: Bull with horns × cow without horns ✓
Genotype: pp × Pp ✓
Meiosis
G/Gametes: p, p × P, p ✓
Fertilisation
F1
Genotype: Pp pp Pp pp ✓
Phenotype: No horns Horns No horns Horns✓

P1 and F1✓
Meiosis and fertilisation✓

2/4×100% = 50%✓*
Any 6 + **1***

OR

P1 Phenotype: Bull with horns × Cow without horns ✓
Genotype: pp × Pp ✓
Meiosis
Fertilisation
F1
Phenotype:

Cow without horns	Bull with horns: p	Bull with horns: p
Gametes	p	p
P	Pp No horns	Pp No horns
p	pp Horns	pp Horns

✓(correct gametes)
✓ (correct genotype)
2 horned calves 2 calves without horns ✓

P1 and F1✓
Meiosis and fertilisation✓

2/4×100% = 50%✓*
Any 6+**1*** (7)
(15)
[47]

TOTAL SECTION B: 97
GRAND TOTAL: 147

Use the table below to adjust marks to 150.

Mark obtained	
1 – 24	Add 0
25 – 73	Add 1
74 – 93	Add 2
94 – 147	Add 3