education

Department:
Education
PROVINCE OF KWAZULU-NATAL

ENQUIRIES: MR D.A. SEWLALL DATE: 03 JUNE 2016

NATIONAL SENIOR CERTIFICATE: COMMON TEST JUNE 2016: GRADE 12

TO: THE CHIEF INVIGILATOR OF ALL SCHOOLS OFFERING: LIFE SCIENCES

ERRATA

Please take note of the following change:

PAGE	NUMBER	ERROR	CORRECTION
10	2.3.3 (b)	(b) Describe the process named in QUESTION **2.3.2(a)**	(b) Describe the process named in QUESTION **2.3.3(a)**

Kindly ensure that candidates are informed of the Errata.

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DEPUTY MANAGER
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3/6/2016
DATE

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Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

COMMON TEST

JUNE 2016

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 150

TIME: 2½ hours

N.B. This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

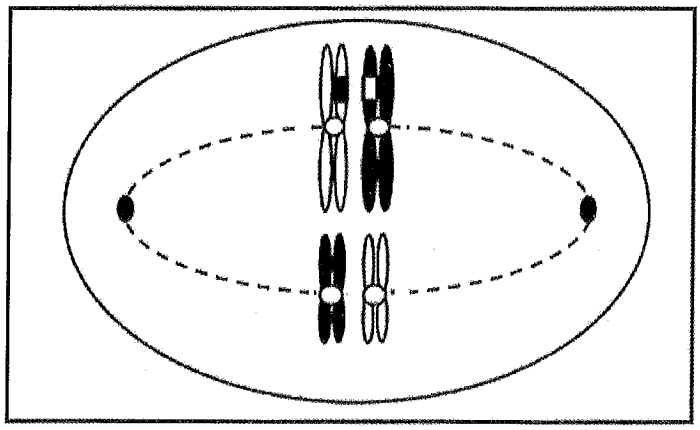
1. Answer ALL the questions.
2. Write ALL the answers in your ANSWER BOOK.
3. Start the answers to each question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. ALL drawings must be done in pencil and labelled 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 where necessary.
11. Write neatly and legibly.

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 The phase of meiosis shown in the diagram below is metaphase I because ...



A crossing over has occurred
B homologous pairs are being pulled to the poles
C homologous pairs are lined up at the equator
D the nuclear membrane has disappeared.

1.1.2 The information below is the DNA sequence for normal haemoglobin and the mutation on that gene that causes sickle cell anaemia.

1 2 3 4 5 6 7
CAC CTG GAC TGA GGA CTC CTC – normal haemoglobin

CAC GTG GAC TGA GGA CAC CTC – sickle cell anaemia

The mutation that causes sickle cell anaemia is on coding triplet number ...

A 2, T is replaced with G and 6, T is replaced with A
B 2, C is replaced with G and 6, T is replaced with A
C 6, C is replaced with G and 2, T is replaced with A
D 6, A is replaced with T and 2, G is replaced with C

1.1.3 A contraceptive pill that contains progesterone prevents pregnancy because it ...

A inhibits the production of FSH
B maintains the thickness of the endometrium
C blocks the sperm from entering the Fallopian tubes
D prevents menstruation.

1.1.4 The correct pathway of sperm out of the male body is ...

A urethra, vas deferens, epididymis.
B epididymis, vas deferens, urethra.
C epididymis, urethra, vas deferens.
D vas deferens, epididymis, urethra.

1.1.5 If 20% of the bases in a DNA molecule are thymine what is the ratio of thymine to guanine in the molecule?

A 1 : 1
B 2 : 1
C 3 : 2
D 2 : 3

1.1.6 Reproductive strategies used by the organisms shown in the diagrams below are ...

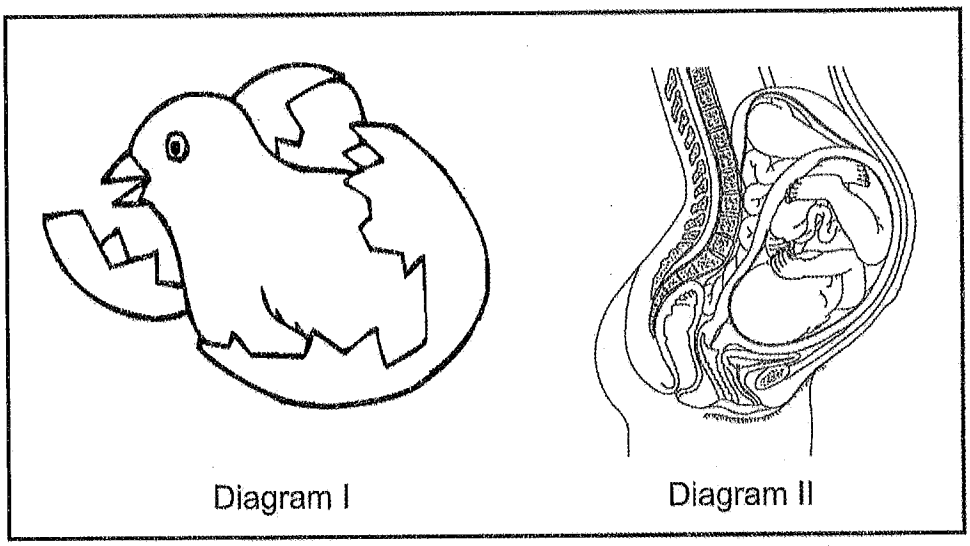
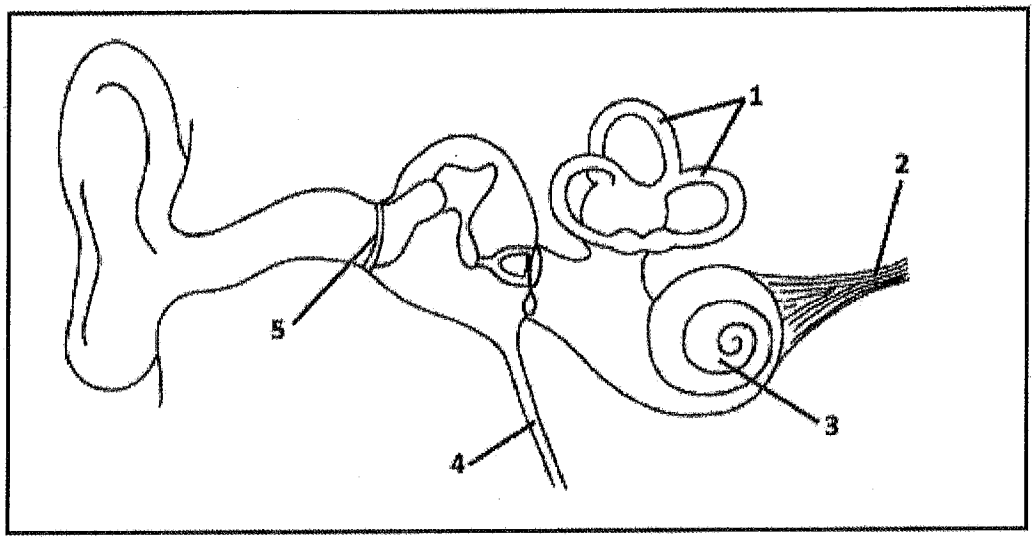


	Diagram I	Diagram II
A	ovipary	ovovivipary
B	vivipary	ovipary
C	ovipary	vivipary
D	ovovipary	vivipary

1.1.7 John hears a hissing noise and spins around to see if there is a snake behind him. The parts of the brain involved in interpreting the stimulus and maintaining his balance while turning are ...

	Interprets sound	Maintains balance
A	cerebrum	cerebellum
B	medulla oblongata	cerebrum
C	cerebellum	hypophysis
D	cerebrum	medulla oblongata

1.1.8 The part of the ear into which grommets are inserted is part numbered…

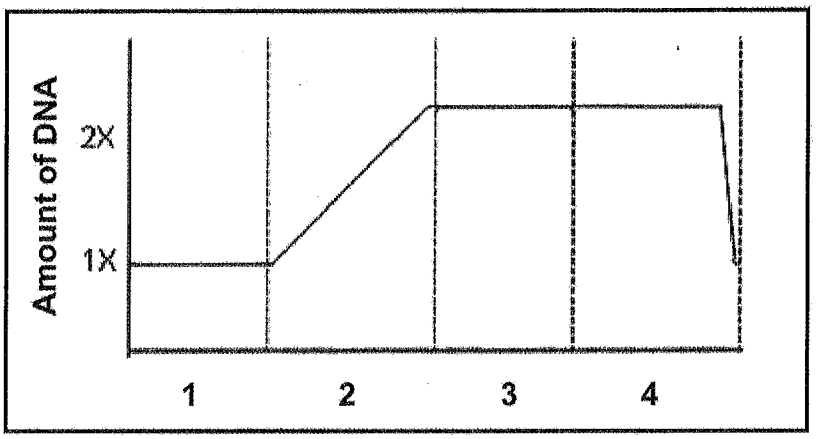


A 2
B 4
C 1
D 5

1.1.9 RNA differs from DNA in that it …

A it is single stranded and contains uracil
B it is single stranded and contains thymine
C it is single stranded and contains adenine
D it is single stranded and has paired nitrogen bases

1.1.10 The diagram below shows the changes in the amount of DNA in a cell during the cell cycle.



The stage on the graph that represents DNA replication is …

A 1
B **2**
C **3**
D **4**

2 x 10 **(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 1.2.8) in your ANSWER BOOK.

1.2.1 The meiotic process by which male gametes are produced

1.2.2 The part of the testes where meiosis occurs

1.2.3 The hormone responsible for the development of secondary sexual characteristics in males.

1.2.4 The position of a gene on the chromosomes

1.2.5 A genetic cross in which both alleles are equally expressed in the phenotype

1.2.6 Organisms that have had a gene from another species inserted into their genome.

1.2.7 The bond that holds the monomers of proteins together.

1.2.8 The part of the nervous system that controls involuntary actions.

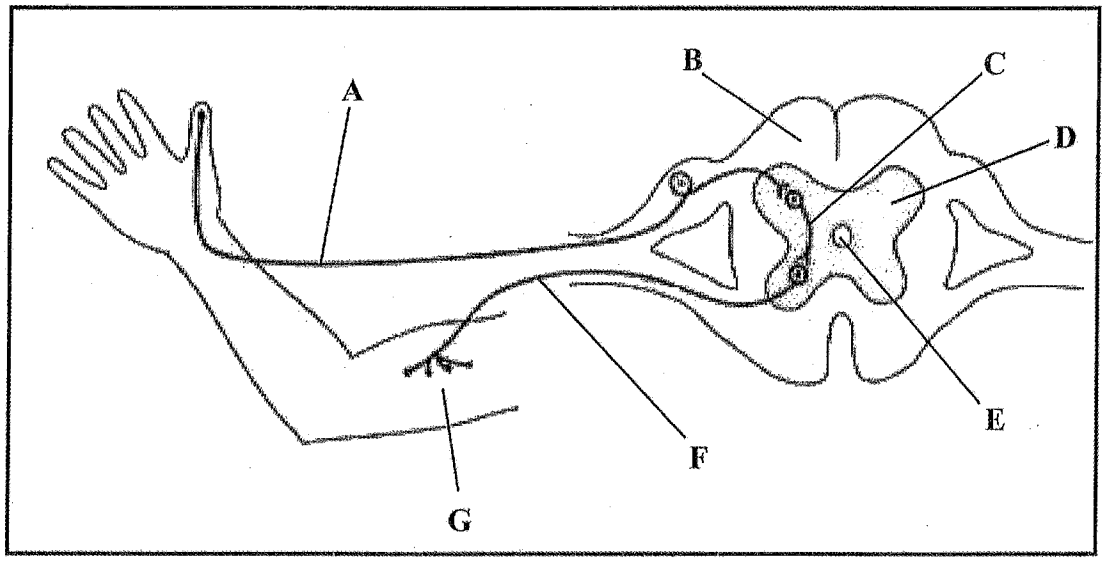
(8)

1.3 Indicate whether each of the statements in COLUMN 1 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 1.3.4) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Characteristic of a DNA molecule	A: Helical B: Double stranded
1.3.2	Fertilization that does not rely on an aquatic environment	A: Internal B: External
1.3.3	Hatchlings are poorly developed and unable to feed on their own	A: Precocial B: Altricial
1.3.4	Genetic disorder/s as a result of chromosomal aberrations	A: Colour blindness B: Albinism

(4 x 2) **(8)**

1.4 The diagram below represents a relex arc.



Give the LETTER and the NAME of the part that :

1.4.1 contains cerebrospinal fluid (2)

1.4.2 transmits impulses from the receptor (2)

1.4.3 transmits impulses from one neuron to the another neuron (2)

1.4.4 transmits impulses to the muscle (2)
(8)

1.5 A farmer collected the seeds from his crop to use for planting in the following season. He saw that the seed had different characteristics and he grouped them as follows.

Characteristic	Number of Seeds
Oval and yellow	103
Round and yellow	298
Round and brown	910
Oval and brown	304

Use the letters **T** and **t** for the shape of the seeds and **F** and **f** for the colour of the seeds.

1.5.1 Which **TWO** characteristics are dominant? (2)

1.5.2 Name the type of cross that resulted in these characteristics of the seeds. (1)

1.5.3 (a) Give the genotype of the parent plants. (1)

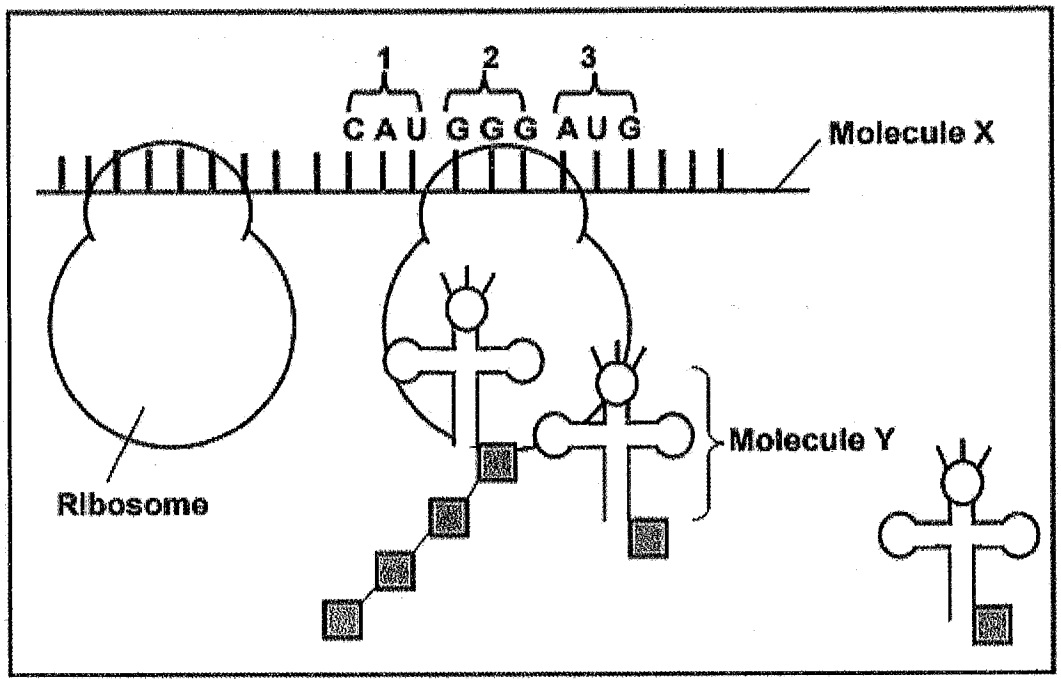
(b) Give the genotypes of the gametes produced by the parent plants (2)
(6)

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) molecule X (1)

(b) molecule Y (1)

2.1.2 (a) Name the process that formed molecule X (1)

(b) Describe the process named in QUESTION 2.1.2 (a). (4)

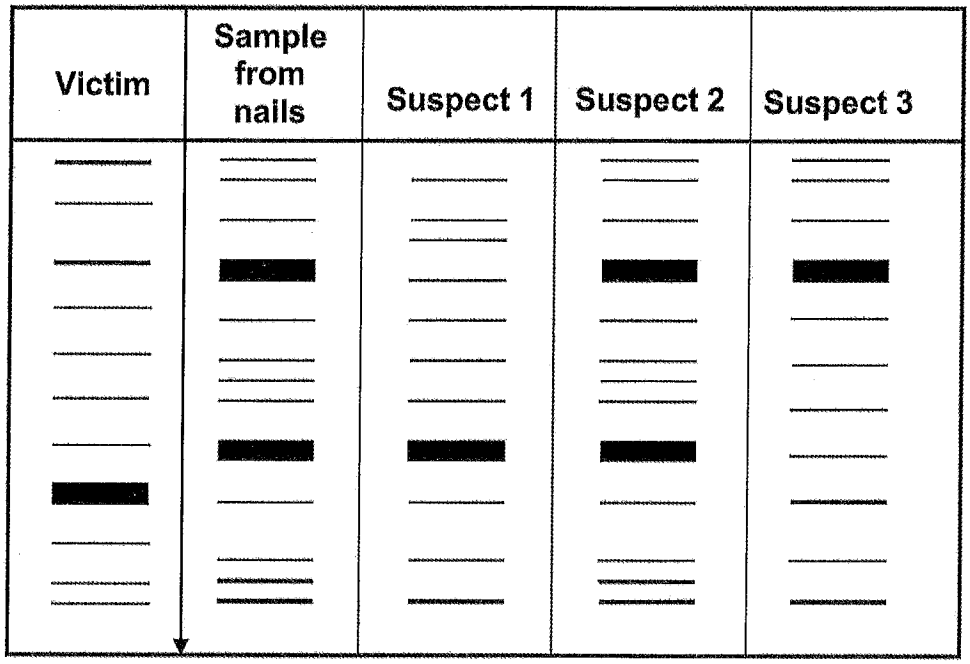
2.1.3 The table below shows the DNA base triplets that code for different amino acids found in human proteins

AMINO ACID	BASE TRIPLET IN DNA
Leucine	GAA
Proline	GGG
Lycine	TTT
Histidine	GTA
Serine	TCA
Methionine	TAC
Glycine	CCC
Glutamine	GTC

Using the information in the table and the diagram above, describe the consequence if triplet 1 changes to CAG and triplet 3 changes to AGU in the above process. (3)

(10)

2.2 The victim of an attack scratched her attacker. A sample of blood and skin cells were collected from under the victims nails. This sample was used to produce the attackers DNA profile. DNA profiles for the victim and three suspects were also produced. The DNA profiles are shown in the diagram below.



2.2.1 (a) Which suspect attacked the victim? (1)

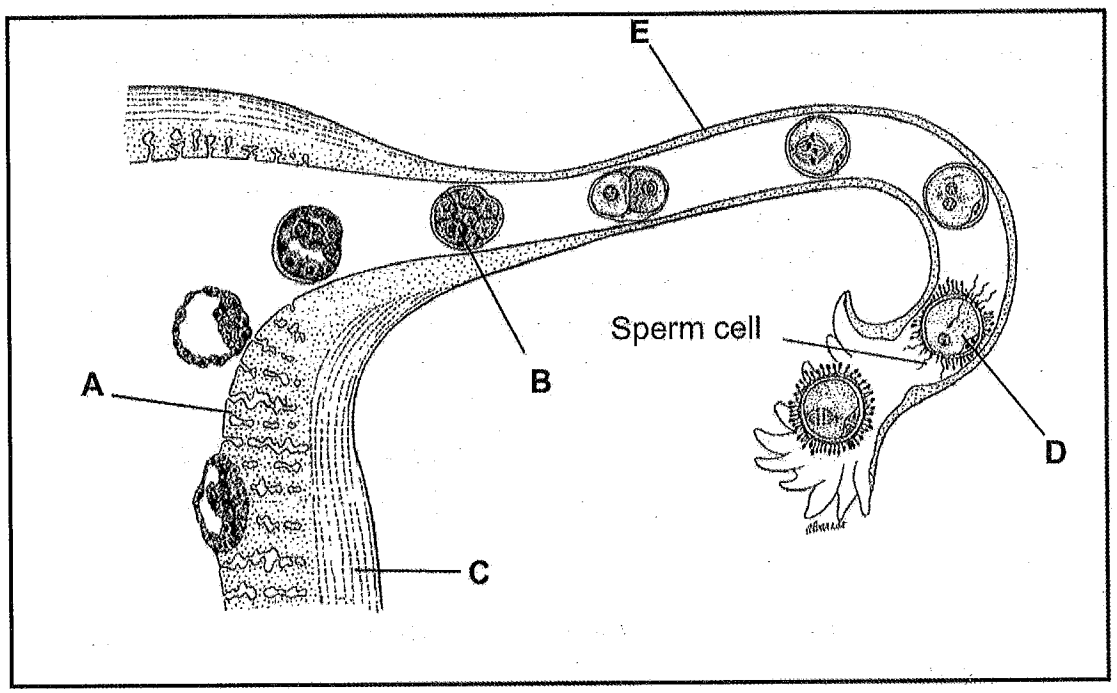
(b) Give an explanation for your answer. (1)

2.2.2 When confronted the attacker says that the victim scratched herself in order to frame him. Explain why this is not possible. (2)

2.2.3 Explain ONE reason why a DNA profile alone is not sufficient evidence to convict someone of the crime. (2)

2.2.4 Explain ONE advantage of using DNA profiles in solving crimes (2)
(8)

2.3 The diagram below shows part of the reproductive system of a female.



2.3.1 Identify parts:

(a) B (1)

(b) E (1)

2.3.2 Give the letter of the part that is stimulated by the hormone oxytocin. (1)

2.3.3 (a) Name the process that is occurring at D. (1)

(b) Describe the process named in QUESTION 2.3.2(a) (5)

2.3.4 Explain the consequence in this woman if part A did not develop. (3)

(12)

2.4 Menkes syndrome is a recessive sex-linked disorder occurring on the X-chromosome that affects copper levels in the body. Children born with Menkes syndrome do not survive past the age of three years.

The normal allele is represented by X^M and the allele for Menkes syndrome is represented by X^m.

2.4.1 Give possible genotypes of a:

(a) female sufferer (1)

(b) male sufferer (1)

2.4.2 A woman whose uncle died of the disease at the age of three would like to start a family. Explain why she should consider seeing a genetic counsellor before falling pregnant. (2)

2.4.3 A normal man and a woman who carries the allele for Menkes syndrome have three son's who are all normal. Use a genetic diagram to determine the chances of their next son suffering from Menkes syndrome (6)
(10)
[40]

QUESTION 3

3.1 A film star is involved in a paternity dispute. The woman who has opened the case against him has two children. The judge ordered that blood tests be done to see if the film star could be the father of both children.

The results of the blood tests are as follows:

The woman : O type blood
The film star: AB type blood
Child 1: O type blood
Child 2: B type blood

3.1.1 How many alleles code for blood groups in humans? (1)

3.1.2 Give the genotypes of:

(a) the woman (1)

(b) the film star (1)

(c) the child with B blood if the film star is the father (1)

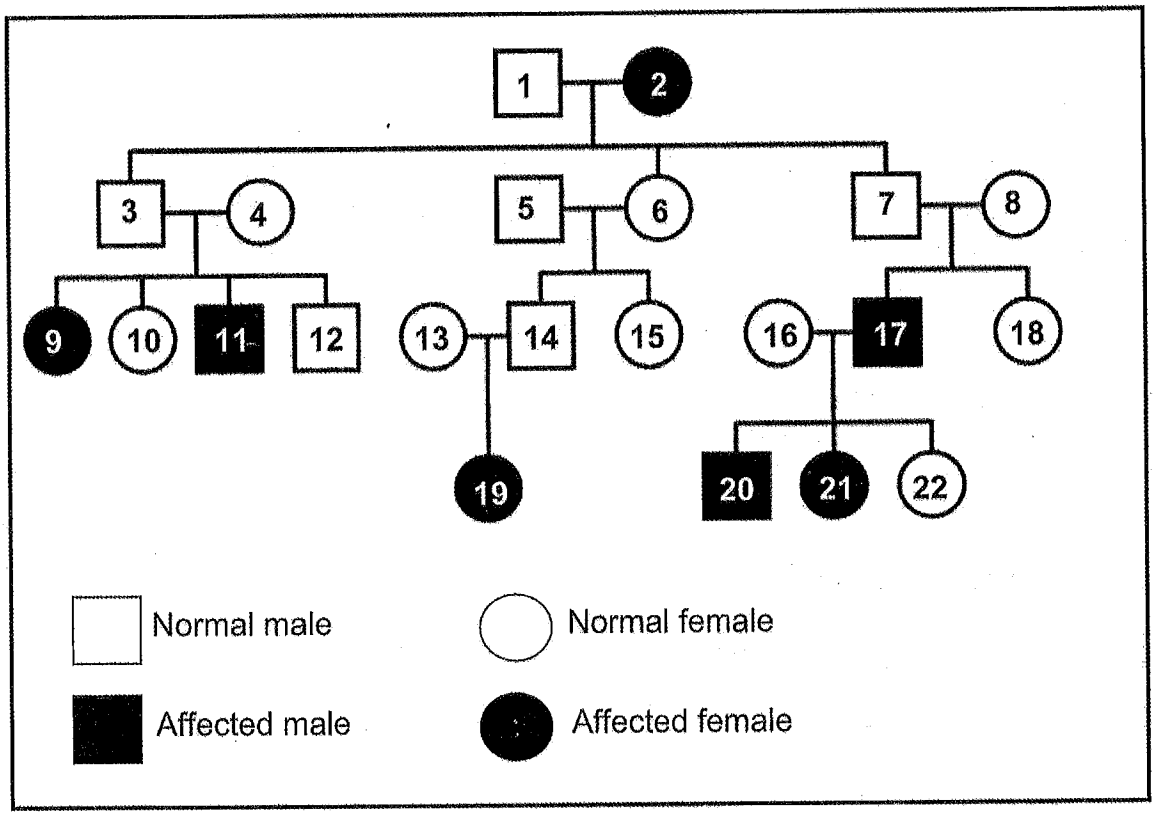
3.1.3 What is the percentage chance that these parents could have a child with …

(a) O type blood? (1)

(b) B type blood? (1)

3.1.4 Explain why, when presented with the evidence, that the judge decided to proceed with the case but could not finalize the matter. (3)
(9)

3.2 Angelman syndrome is a genetic disorder that affects the nervous system and results in mental disability, seizures and jerky movements. The pedigree diagram below shows the inheritance of this disorder in a family. Use 'A' for a normal allele and 'a' for the Angelman syndrome allele.



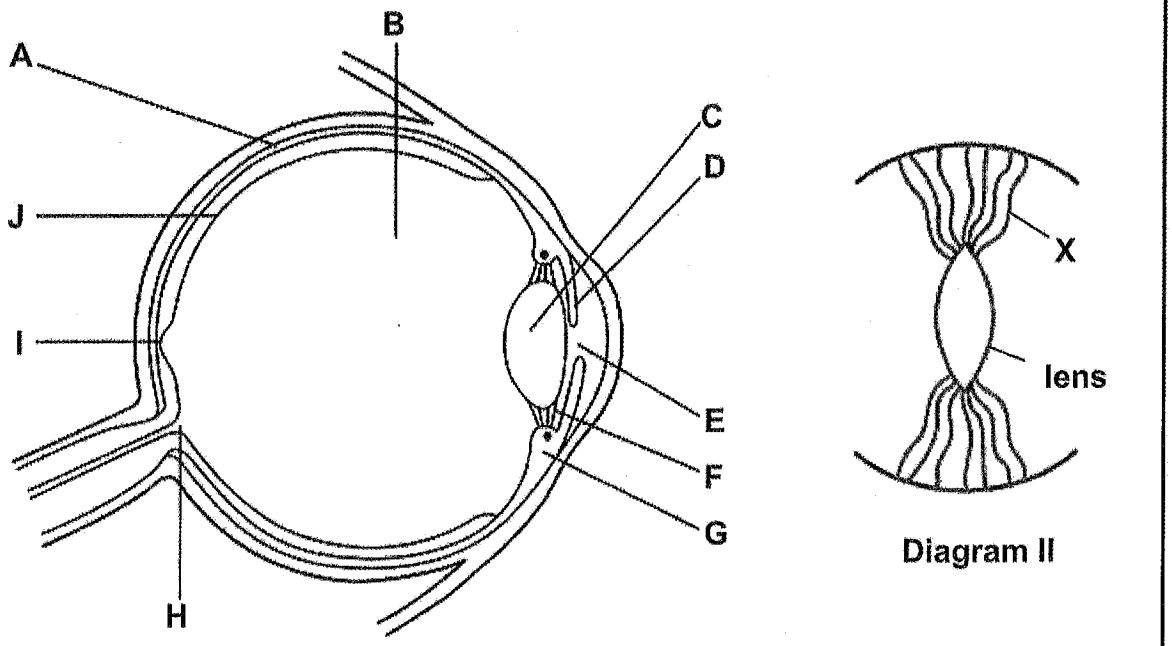
3.2.1 What evidence from the pedigree suggests that this is not a sex-linked disorder? (1)

3.2.2 What is the genotype of individual 4? (2)

3.2.3 Explain why the following statement is incorrect.

Individuals 13 and 14 already have one child who is affected by Angelman Syndrome therefore there is no chance that their next child will be affected. (3)
(6)

3.3 The diagrams below show the structure of a human eye and a simple representation of part of the eye under different conditions.



3.3.1 Identify the following parts and give ONE function of each part:

(a) **A** (2)

(b) **D** (2)

3.3.2 Give the letters from diagram I that are represented as **X** in diagram II (1)

3.3.3 (a) Name the process occurring in the eye that is represented in diagram **II**. (1)

(b) Explain what has occurred to result in the process shown in diagram **II**. (5)

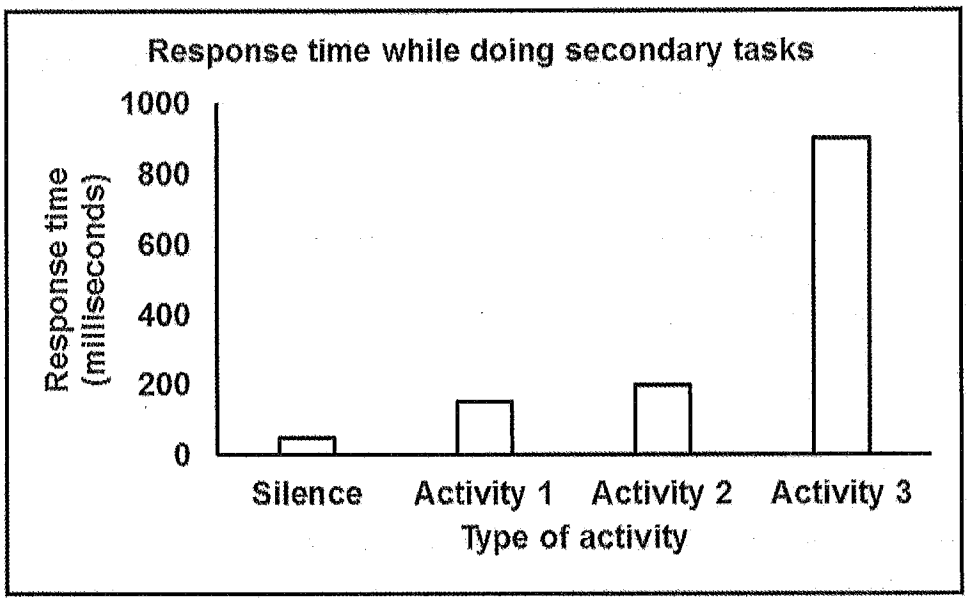
3.3.4 Explain why a person cannot see if an image falls on part labelled **H**. (3)
(14)

3.4 Theresa carried out an investigation to determine the effect that different activities have on a person's reaction time.

The procedure followed was:

- A participant was asked to press a button on hearing a bell
- This was repeated 5 times in silence and then an average calculated
- The participant was asked to press a button on hearing a bell while doing the following activities:
  Activity 1 - listening to music
  Activity 2 - answering simple questions
  Activity 3 - doing mental mathematics

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



Adapted from :http://journalistsresource.org

3.4.1 Which part of the brain is responsible for the movements needed to press the button? (1)

3.4.2 Give **ONE** other function of this part of the brain other than the function mentioned in QUESTION 3.4.1. (1)

3.4.3 State **ONE** way in which the investigator ensured the reliability of the investigation. (1)

3.4.4 What was the independent variable in this investigation. (1)

3.4.5 Which activity (**1**, **2** or **3**) had the longest response time? (1)

3.4.6 What is the response time for activity **2**? (2)

3.4.7 Explain the purpose of carrying out the procedure in silence at the start of the investigation. (2)

3.4.8 Use evidence from the graph to explain why holding a conversation on the phone while driving a car is dangerous. (2)

(11)

[40]

TOTAL SECTIONB: [80]

SECTION C

QUESTION 4

Describe oogenesis and the events in meiosis that introduce genetic variation in ova and describe the hormonal control of the production of oogenesis and ovulation.

Content (17)
Synthesis (3)

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

TOTAL SECTION C: (20)

TOTAL MARKS: [150]

Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

MEMORANDUM

COMMON TEST

JUNE 2016

NATIONAL SENIOR CERTIFICATE

GRADE 12

This memorandum consists of 9 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES 2016

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 part of it is required**
   Read all and credit relevant part.

4. **If comparisons are asked for and descriptions are given**
   Accept if 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 is incorrect, do not credit. If sequence and links becomes correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in answer. If not defined, do not credit the unrecognized abbreviation but credit the rest of 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 recognizable accept 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 letter is asked for and only name is given (and vice versa)**
No 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

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

SECTION A

QUESTION 1

1.1
1.1.1 C✓✓
1.1.2 B✓✓
1.1.3 A✓✓
1.1.4 B✓✓
1.1.5 D✓✓
1.1.6 C✓✓
1.1.7 A✓✓
1.1.8 D✓✓
1.1.9 A✓✓
1.1.10 B✓✓ (10 x 2) **(20)**

1.2
1.2.1 Spermatogenesis✓
1.2.2 Seminiferous tubules✓
1.2.3 Testosterone✓
1.2.4 Locus✓
1.2.5 Co-dominance ✓
1.2.6 Genetically modified✓/transgenic /genetically engineered
1.2.7 Peptide✓ bond
1.2.8 Autonomic✓/medulla oblongata
(8 x 1) **(8)**

1.3
1.3.1 Both✓✓
1.3.2 A only✓✓
1.3.3 B only✓✓
1.3.4 None ✓✓ (4 x 2) **(8)**

1.4
1.4.1 E✓ - central canal✓ (2)
1.4.2 A✓ - sensory neuron✓ (2)
1.4.3 C✓ - interneuron✓/connector neuron (2)
1.4.4 F✓ - motor neuron✓ (2)
(8)

1.5
1.5.1 Round✓ and brown✓ * (2)

1.5.2 Dihybrid✓ (1)

1.5.3 (a) TtFf✓ (1)
(b) TF ; Tf ; tF ; tf✓✓ (2)
(6)

TOTAL QUESTION 1: [50]

TOTAL SECTION A: [50]

SECTION B

QUESTION 2

2.1

2.1.1 (a) mRNA✓ (1)
(b) tRNA✓ (1)

2.1.2 (a) Transcription✓ (1)
(b) - The double-stranded DNA unwinds✓
- The hydrogen bonds break✓
- and the two strands separate✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides✓ from the nucleoplasm
- The mRNA formed is complementary to the DNA✓ (Any 4) (4)

2.1.3 - A gene mutation occurs✓
- The sequence of amino acids changes✓
- from histidine and methionine✓
- to glutamine and serine✓
- and hence, changing the type of protein formed ✓ (Any 3) (3)
(10)

2.2

2.2.1 (a) Suspect 2✓ (1)
(b) The DNA profile for suspect 2 is identical to the DNA profile in the sample from the nails✓ (1)

2.2.2 The victims DNA profile is different✓ to the DNA profile of the sample from under her nails✓
OR
The attackers DNA✓ was found under the nails of the victim✓ (2)

2.2.3 - The DNA sample could have been planted✓ at the crime scene in order to frame someone✓
- The person could have been at the scene previously✓ but was not involved in the crime✓
- Large amounts of DNA✓ are required to be reliable✓ (Any 1 x 2) (2)
Mark first ONE only

2.2.4 - DNA profiles are unique to every person✓
- therefore if their DNA is found at a crime scene they must have been there✓
OR
- Increase the chances of convictions✓
- thus decreasing the crime rate✓
(2)
(8)

2.3

2.3.1 (a) Morula ✓ (1)
(b) Fallopian tube✓/oviduct (1)

2.3.2 (Question excluded)

2.3.3 (a) Fertilization✓ (1)
(b) - One sperm cell makes contact with the ovum's membrane✓
- Enzymes from the acrosome✓
- make the membrane of the ovum more permeable✓
- The nucleus of the sperm enters the ovum✓
- and the ovum becomes impenetrable✓ to other sperms
- The nucleus of the sperm fuses✓
- with the nucleus of the ovum✓
- to form a diploid zygote✓ (Any 5) (5)

2.3.4 - - The endometrium will not thicken ✓
- Implantation will not take place✓
- A miscarriage will occur✓ (3)
(11)

2.4

2.4.1 (a) X^mX^m✓ (1)
(b) X^mY✓ (1)

2.4.2 - The allele for Menkes occurs in her family✓
- therefore she may be a carrier✓
- A genetic counsellor would be able to determine her chances of having a child that would suffer from the disease✓
- To assist in making a decision on whether to have children✓
- Or how to cope with a child with the disorder✓ (Any 2) (2)

2.4.3

P_1 Phenotype Normal x Normal✓(carrier)
Genotype X^MY x X^MX^m✓

Meiosis

Fertilisation

Gametes	X^M	Y
X^M	X^MX^M	X^MY
X^m	X^MX^m	X^mY

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype 2 normal females ; 1 normal male ;
1 affected male✓
50% / 1 out of 2 chance (*1 compulsory mark)

P_1 and F_1✓
Meiosis and fertilisation✓
(*1 (compulsory + any 5 other) (6)

(10)

TOTAL QUESTION 2: [39]

QUESTION 3

3.1

3.1.1 Three / 3✓ (1)

3.1.2 (a) ii✓ (1)
(b) I^AI^B✓ (1)
(c) I^Bi✓ (1)

3.1.3 (a) 0✓% (1)
(b) 50✓% (1)

3.1.4 - The film star could be the father of child 2 ✓
- but could not be the father of child 1✓
- This does not mean that he definitely is the father of child 2✓
- because many people have blood group B✓
- Further tests/DNA profiles need to be done to prove if he is the father✓
(any 3) (3)
(13)

3.2

3.2.1 More females than males suffer from the disorder✓ (1)

3.2.2 Aa ✓✓ (2)

3.2.3 - Parents 13 and 14 must be heterozygous✓
- There is a 25% chance that they can have a child with the syndrome✓/75% chance that they will have a normal child
- This chance applies each time they have a child✓ (3)
(6)

3.3

3.3.1 (a) Choroid✓ - absorbs excess light in the eye✓/provides the eye with nutrients (2)

(b) Iris✓ - regulates the size of the pupil✓/ regulates the amount of light that enters the eye (2)

3.3.2 F✓ (1)

3.3.3 (a) Accommodation✓ (1)

(b) - The person is looking at an object that is closer than 6m✓
- The ciliary muscles contract✓
- and tension on the suspensory ligaments is released✓
The tension on the lens decreases✓
- and the lens becomes more convex✓
- to increase the refraction of light ✓
- so that a clear image is formed on the retina✓

OR

- The person looking at an object that is further than 6m✓
- The ciliary muscles relax✓
- and the tension of the suspensory ligament increases✓
- The tension on the lens increases✓
- and the lens become less convex✓
- to decrease the refraction of light✓
- so that a clear image is formed on the retina✓
(Any 5) (5)

3.3.4 - Part H/the blind spot✓
- contains no photoreceptors✓/ rods and cones
- to change the light stimulus into a nerve impulse✓
- Therefore no impulse is sent to the cerebrum✓
(Any 3) (3)
(14)

3.4

3.4.1 Cerebrum✓/cerebellum (1)

3.4.2 Interpret information from sensory organs✓/Higher thought processes/judgement/memory/ intelligence
OR
Maintains balance and equilibrium✓ (1)

3.4.3 He repeated each measurement five times✓/calculated an average (1)

3.4.4 The type of activity✓ (1)

3.4.5 3✓ (1)

3.4.6 Accept any answer from 190 - 210✓ milliseconds✓ (2)

3.4.7 To provide a baseline✓/control to compare the other results to✓ (2)

3.4.8 - The reaction time increases✓/ response will be slow
- and this may lead to an accident✓
(Any 2) (2)
(11)

TOTAL QUESTION 3: [40]

TOTAL SECTION B: [79]

SECTION C
QUESTION 4

Oogenesis

- Diploid cells in the ovary✓/germinal epithelium
- undergo meiosis ✓
- to form a primary follicle ✓
- consisting of haploid cells✓
- One cell develops into an ovum ✓
- in a Graafian follicle ✓ Any (4)

Processes that introduce genetic variation

1. Crossing over✓

- During prophase I✓
- Homologous chromosomes pair✓
- and their chromatids touch✓/overlap
- at points called chiasmata✓
- and genetic information is exchanged✓

2. Random arrangement of chromosomes✓

- During metaphase ✓
- the chromosomes are arranged at the equator✓
- Their arrangement at the equator is random✓ Any (7)

Hormonal control of the production of ova

- Low levels of progesterone✓
- stimulate FSH✓ production
- by the pituitary gland✓
- to form a follicle✓/ovum
- The pituitary gland✓
- secretes high levels of LH✓
- which stimulates ovulation✓
- and converts the Graafian follicle into the corpus luteum ✓ Any (6)

Content (17)
Synthesis (3)
(20)

Criterion	Relevance (R)	Logical sequence(L)	Comprehensive (C)
In this essay	Only information relevant to the oogenesis, introduce genetic variation in meiosis and the hormonal control of the production of ova and ovulation (no unnecessary detail)	Logical flow to answer with regard to oogenesis, introduce genetic variation in meiosis and the hormonal control of the production of ova and ovulation	At lease the following points must be included: oogenesis (2/4) Introduction of variation – 4/7 Hormonal control of ova production and ovulation – 3/6
Marks	1	1	1

TOTAL SECTION C: [40]
GRAND TOTAL: 149

In view of QUESTION 2.3.2 being excluded the paper should be marked out of 149 and converted to a mark out of 150 as follows:-

0 – 74: no change in marks
75 – 149: add 1 mark to the total mark of the learner