



# **Basic Education**

**KwaZulu-Natal Department of Basic Education  
REPUBLIC OF SOUTH AFRICA**

**LIFE SCIENCES**

**COMMON TEST**

**JUNE 2014**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MARKS: 150**

**TIME: 2½ hours**

**This question paper consists of 13 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 should be done in pencil and labelled in blue or black ink.
7. Draw diagrams 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 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 Which of the following could be used to prepare a microscope slide of cells undergoing meiosis?

- A Locust testis
- B Pea plant root tip
- C Tissue from a mammary gland
- D Sunflower petals

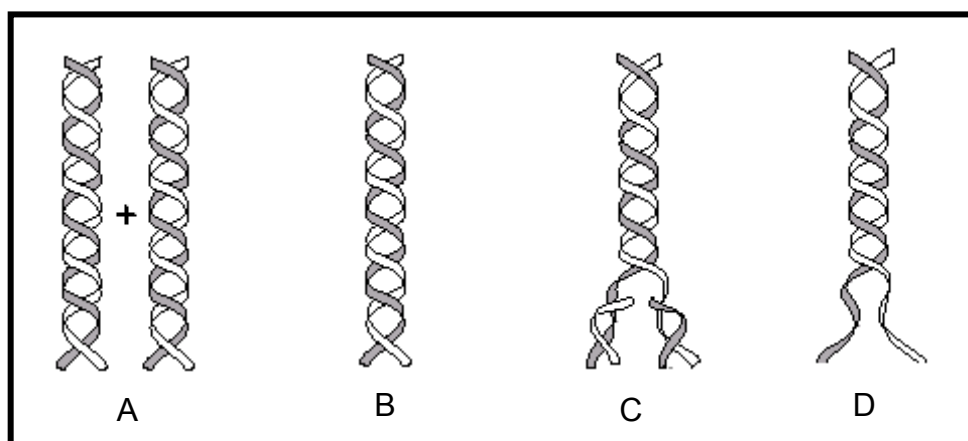
1.1.2 Study the list of characteristics below.

- (i) The sugar is deoxyribose
- (ii) It is found in the nucleus
- (iii) There is normally a constant amount found in all somatic cells of a particular species

Which of the above characteristics apply to DNA?

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











1.1.3 The diagrams A to D represent the steps that occur during the process of DNA replication.



The correct order in which these diagrams should appear is ...

- A A, B, C, D
- B B, C, A, D
- C A, D, B, C
- D B, D, C, A

THE DIAGRAM BELOW REPRESENTS THE RESULTS OBTAINED FROM THE PROFILE OF A MOLECULE, FOUND IN EACH OF THE INDIVIDUAL'S NUCLEUS OF A CELL IN THEIR BODIES, RELATING TO A CRIME SCENE.  
QUESTION 1.1.4 AND 1.1.5 RELATE TO THE DIAGRAM.

SUSPECT NUMBER			VICTIM	CRIME SCENE SAMPLE
1	2	3		
				
				
				
				
				

1.1.4 The bands on the profiles represent ...

- A DNA fragments.
- B genes.
- C chromosomes.
- D chromatids.

1.1.5 Which of the suspects was definitely at the crime scene?

- A Suspect 1 only
- B Suspect 2 only
- C Suspect 3 only
- D Suspects 2 and 3

1.1.6 Which of the following can be observed in a karyotype?

- A A change in a DNA base sequence
- B Extra chromosomes
- C Gene mutations
- D Alleles

1.1.7 Study the following statements:

- (i) Produces hormones to maintain pregnancy
- (ii) Produces amniotic fluid
- (iii) Exchange of substances between the mother's blood and blood of the foetus
- (iv) Mixing of mother's blood and the blood of the foetus
- (v) Attaches foetus to the mother

Which ONE of the following combinations refers to the correct functions of the placenta in a human being?

- A (i); (ii); (iii) only
- B (i); (iii); (v) only
- C (i); (iii); (iv) only
- D (i); (iv); (v) only

1.1.8 Which pair of statements below is a CORRECT difference between mitosis and meiosis?

	<b>Mitosis</b>	<b>Meiosis</b>
A	The chromosome number remains constant	The chromosome number is halved
B	DNA replication takes place during prophase	DNA replication takes place during anaphase
C	The cytoplasm divides twice	The cytoplasm divides once
D	Daughter cells are different from each other	Daughter cells are identical to each other

1.1.9 Organisms that give birth to live young may be ...

- A viviparous or oviparous.
- B oviparous or ovo-viviparous.
- C viviparous only.
- D ovo-viviparous or viviparous.

1.1.10 The DNA of one species differs from another species in its ...

- A type of sugar.
- B sequences of base pairs.
- C site of production.
- D phosphate groups.

(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 1.2.10) in your ANSWER BOOK.

- 1.2.1 The basic unit of which nucleic acids are composed
- 1.2.2 An amino acid chain consisting of fewer than fifty amino acids
- 1.2.3 Chromosomes that are not sex chromosomes
- 1.2.4 The transfer of a selected gene from one organism into another
- 1.2.5 An allele that is not shown in the phenotype when found in the heterozygous condition
- 1.2.6 The genetic make-up of an organism
- 1.2.7 The organ where the foetus develops during a pregnancy
- 1.2.8 Type of development where the young are fully mobile when born
- 1.2.9 The type of fertilisation that generally occurs in vertebrates such as fish
- 1.2.10 Covering on the axon that speeds up the transmission of an impulse

(10 x 1)

**(10)**

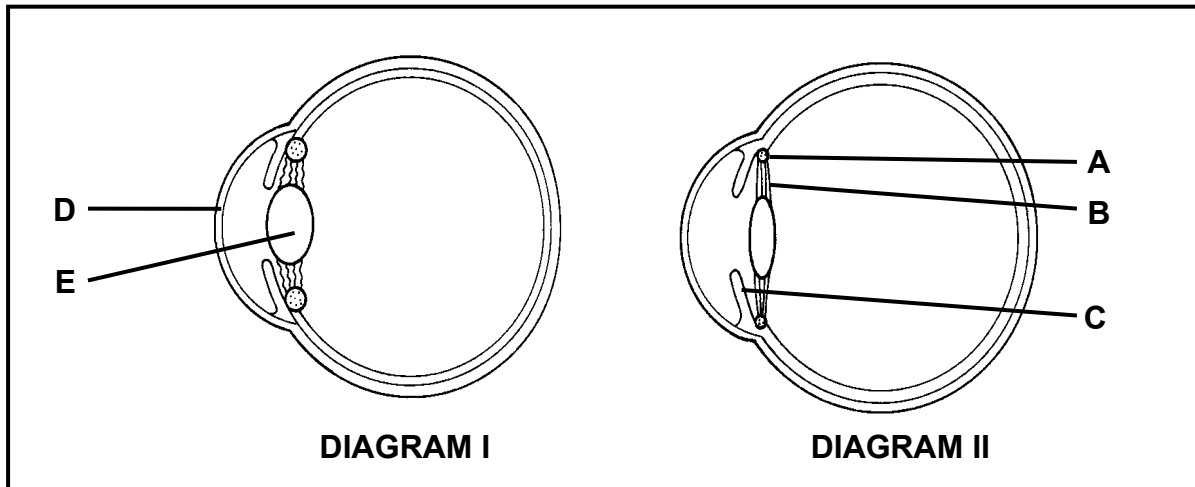
- 1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.6) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Passage through which a baby is born	A:	Cervix
		B:	Vagina
1.3.2	Surrounds and protects the testes	A:	Scrotum
		B:	Epididymis
1.3.3	Influences the inheritance of blood groups	A:	Multiple alleles
		B:	Incomplete dominance
1.3.4	Tube through which sperm and urine pass to the outside	A:	Vas deferens
		B:	Urethra
1.3.5	Carries oxygenated blood and dissolved food from the mother to the foetus	A:	Umbilical vein
		B:	Umbilical artery
1.3.6	Used by the sperm to swim to the ovum	A:	Head
		B:	Acrosome

(6 x 2)

**(12)**

- 1.4 The diagrams below show the changes that take place in the eye when focussing on an object.



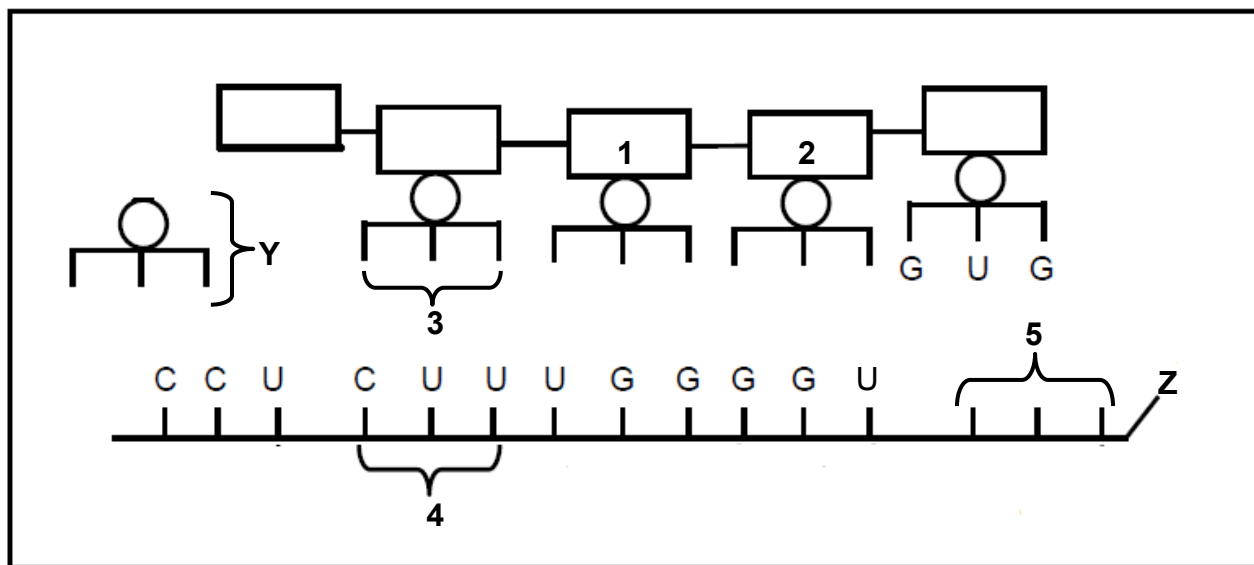
- 1.4.1 Provide labels for parts **A**, **B** and **D**. (3)
- 1.4.2 Write down the LETTER and NAME of the part that provides colour to the eye. (2)
- 1.4.3 Provide the term used to describe the shape of part labelled **E**. (1)
- 1.4.4 Which diagram (I or II) represents the eye of a person looking at an object that is closer than six metres? (1)
- 1.4.5 Is the refractive power of the lens smaller in Diagram I or Diagram II? (1)

**TOTAL QUESTION 1: (8)**  
**[50]**

**TOTAL SECTION A: 50**

**SECTION B****QUESTION 2**

2.1 The diagram below represents a part of protein synthesis.



2.1.1 Identify the molecules labelled **Y** and **Z**. (2)

2.1.2 Name the phase of protein synthesis represented in the diagram. (1)

2.1.3 Give the name of the group of three bases that are indicated by number **4** on the diagram. (1)

2.1.4 Write down the base codes (from left to right) that would be found at point **3** on the diagram. (1)

2.1.5 The table below shows the DNA base triplets that code for the different amino acids.

Amino acid	Base triplet in DNA template
Lys (lysine)	TTT
Ala (alanine)	CGA, GCG
Thr (threonine)	ACC
Pro (proline)	ACA, CCA
Trp (tryptophan)	ACT
Val (Valine)	GTG
Gly (glycine)	TGA, GGC

Write down the names of the amino acids represented by **1** and **5**. (2)  
(7)

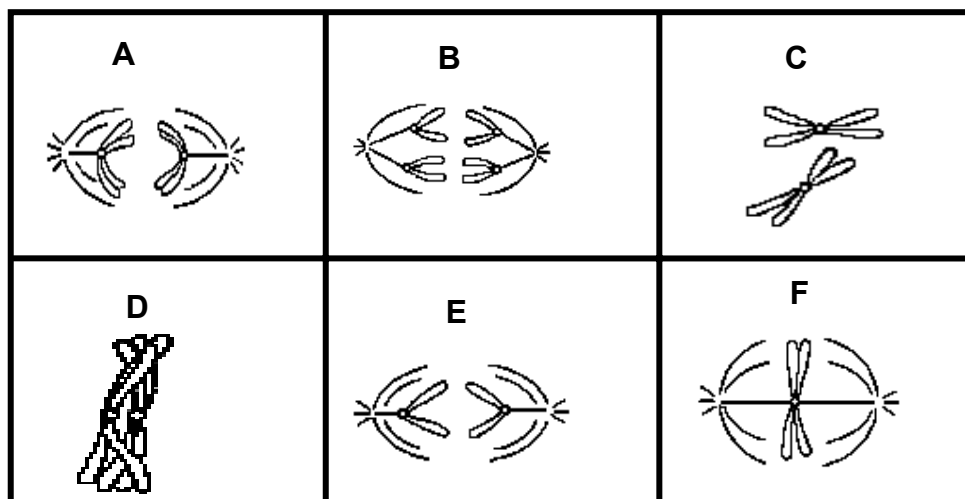


- 2.2 Sickle-cell anaemia is a genetic disorder which causes red blood corpuscles to collapse and form a sickle shape. This reduces their ability to carry oxygen around the body. It is caused by a mutation in the DNA that codes for the protein haemoglobin. Part of the normal sequence for haemoglobin and the mutated part of the DNA are shown below.

Sequence	DNA base triplets			
Normal	TGA	GGA	CTC	CTC
Mutated	TGA	GGA	CAC	CTC

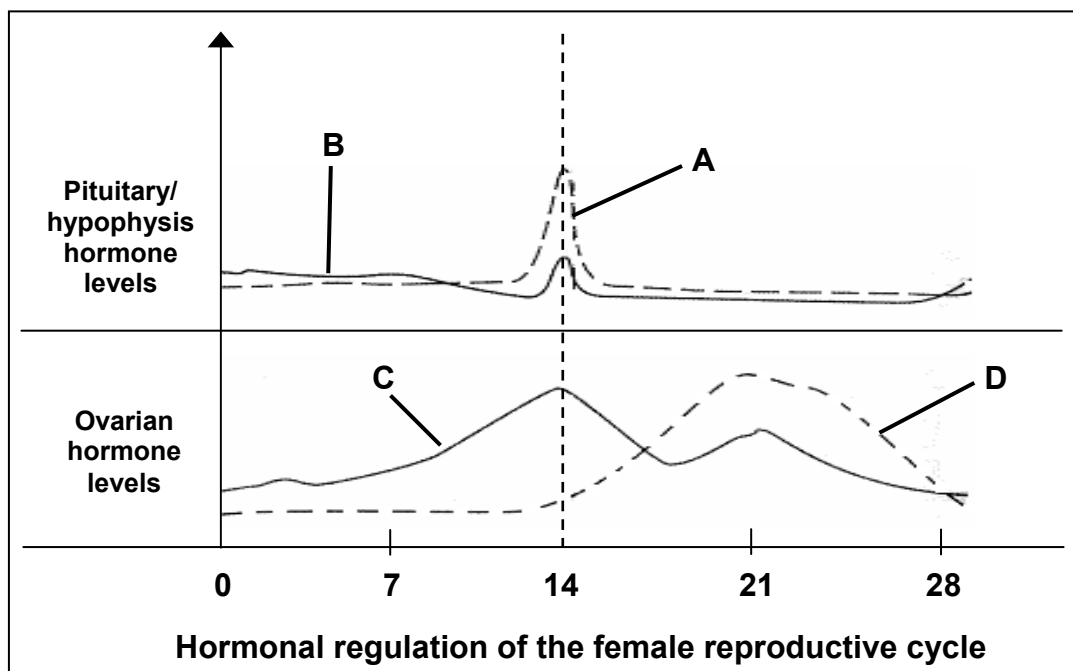
- 2.2.1 How do we know that the base triplets provided in the table are those of DNA? (1)
- 2.2.2 Name the type of mutation that occurs to cause sickle-cell anaemia. (1)
- 2.2.3 Explain how the mutation affects the formation of the required protein. (2)  
(4)

- 2.3 The following diagrams show chromosomes as they might appear during various stages of meiosis I and meiosis II, starting with a cell with a single pair of homologous chromosomes



- 2.3.1 Give the LETTERS of the drawings that represent meiosis I in the correct order in which the phases occur. (3)
- 2.3.2 State ONE visible difference between the events in meiosis represented in diagrams **A** and **E**. (2)
- 2.3.3 Name the process in meiosis represented in the phase shown in diagram **D**. (1)
- 2.3.4 Explain why the process named in QUESTION 2.3.3 is biologically significant. (2)
- 2.3.5 An organism has 20 chromosomes in its body cells. After meiosis the gametes produced contained either 11 or 9 chromosomes. Explain the events in meiosis I that resulted in the gametes having different numbers of chromosomes. (4)  
(12)

- 2.4 Study the graphs below showing the levels of the hormones involved in the menstrual cycle in most women.



- 2.4.1 Provide the label for hormone **A**. (1)
- 2.4.2 According to the graph, during which period of time is the level of hormone **C** lower than the level of hormone **D**? (1)
- 2.4.3 Name and explain the relationship that exists between the hormones labelled **B** and **D** in the menstrual cycle. (4)
- 2.4.4 Describe the changes that occur in the ovary during the 28 day cycle. (4)
- 2.4.5 If fertilisation occurs on day 15, describe the changes that occur in the fertilised egg until the embryo attaches onto the endometrium. (3)
- 2.4.6 A woman takes her temperature reading on a daily basis during her menstrual cycle.  
The table provided below shows her temperature records for days 11 to 19 of one of her menstrual cycles. A slight drop in temperature followed by a sharp rise in temperature indicates that ovulation has occurred.

Day	11	12	13	14	15	16	17	18	19
Temperature °C	36,5	36,6	36,6	36,6	36,6	36,2	37,1	36,9	36,9

- (a) According to the graphs, on which day do most women ovulate? (1)
- (b) Some women use the information in the table to prevent themselves from falling pregnant.

Use the information in the table to explain why this method of preventing pregnancy is not reliable.

(3)  
(17)  
[40]

**TOTAL QUESTION 2:**

**QUESTION 3**

- 3.1 Height in humans is a trait that is controlled by many genes. The Grade 12 learners at a school conducted an investigation to determine the number of girls in their grade that fall into each category of height.

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

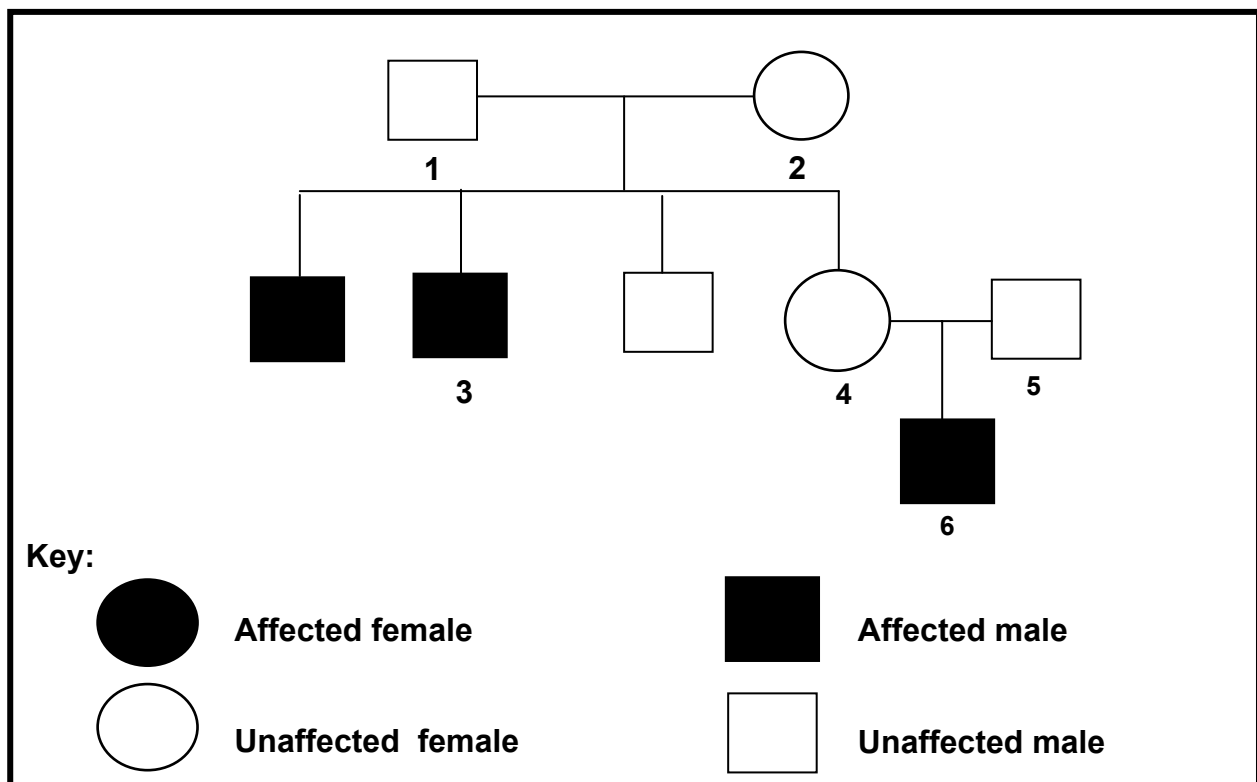
Height (cm)	150-151	152-153	154-155	156-157	158-159	160+
Number of girls	5	18	30	24	14	2

- 3.1.1 Plot a histogram using the information in the table above. (6)
- 3.1.2 List THREE steps that the Grade 12 learners should include in the planning of their investigation. (3)
- 3.1.3 State TWO other possible variables/factors that might have an influence on the height of a person. (2)
- (11)**

- 3.2 In humans the recessive allele ( $X^h$ ) is responsible for haemophilia. The affected individuals bleed easily due to absence of clotting factors.

The dominant allele ( $X^H$ ) ensures that the clotting factors are produced. In this case the individuals are unaffected (do not have haemophilia).

The diagram below shows the occurrence of this disease in a family.



- 3.2.1 State how many people in this family are affected by the disease and

give their genotype. (2)

3.2.2 What is the percentage chance of individuals **1** and **2** producing a child who is an:

(a) affected male (2)

(b) unaffected female (2)

3.2.3 Individual **6** marries an unaffected female.

List **THREE** benefits that could arise if they went for genetic counselling before deciding to have children. (3)

3.2.4 Individual **6** and the unaffected female had 2 children: an unaffected son and an affected daughter.

Represent a genetic cross to show how this was possible. (6)  
(15)

3.3 A rooster with white feathers and a yellow beak mated with a hen with black feathers and a red beak. The  $F_1$  generation consists of 12 chickens; all with white feathers but 9 had yellow beaks and 3 had red beaks.

Use the symbols **F** and **f** for feather colour and **B** and **b** for beak colour.

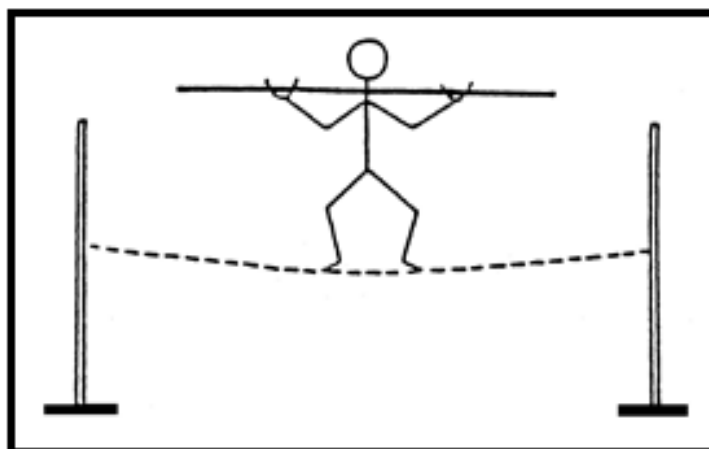
3.3.1 Name the recessive characteristics from the cross given above. (1)

3.3.2 Give the genotype of the rooster and the hen. (2)

3.3.3 Give the possible gametes produced by the rooster. (2)

3.3.4 Write down all the possible genotypes of the  $F_1$  generation. (2)  
(7)

3.4 Describe the mechanism by which the person, a tight-rope walker, in the diagram below is able to maintain balance using his / her ear.



TOTAL QUESTION 3: (7)  
[40]

## SECTION C

**QUESTION 4**

Explain how a person hears the sound of a dog growling and is able to respond rapidly to the touch of its nose on his/her leg.

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

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

**TOTAL SECTION C: 40**  
**GRAND TOTAL: 150**