



LIFE SCIENCES

**SCHOOL-BASED
ASSESSMENT
EXEMPLARS – CAPS**

GRADE 12

LEARNER GUIDE



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA



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1. Introduction

Assessment is a continuous, planned process of identifying, gathering and interpreting information about your performance, using various forms of assessment. It involves four steps:

- **Generating and collecting evidence of achievement**
This is done through the various assessment tasks presented to you by your teacher.
- **Evaluating this evidence**
This is achieved when your teacher marks your answers using a marking guideline to arrive at a mark which indicates your understanding of the topic(s) covered by the assessment task.
- **Recording the findings**
Not only does your teacher record your marks so as to track your progress through the year, but he/she also makes a note of aspects that you and other learners in your class answered poorly.
- **Using this information to understand and assist in your development to improve the process of learning and teaching**
Using information about poorly answered questions, your teacher may choose to re-teach these aspects and then provide further opportunities for you and other learners in the class to assess your improvement in the selected aspects.

Assessment consists of an informal and a formal component. In both cases regular feedback will be provided for you to improve your learning.

- **Informal assessment (Assessment for Learning)**
This component is not used for the purpose of progression and promotion. It consists of a number of assessment tasks presented to you by your teacher on a regular basis. This is usually done within the course of teaching a topic. It is designed to help you consolidate your learning at each stage of a topic to improve your understanding of the next stage of the same topic. Giving full attention to informal tasks is guaranteed to prepare you more adequately for success in the formal component.
- **Formal assessment (Assessment of Learning)**
This component is used for the purpose of progression and promotion. Your teacher will inform you of the number of tasks, the types of tasks and the dates on which you will undertake these assessment tasks. These tasks cover the same topics/skills that are covered by the informal assessment tasks.

Keep track of your progress from the various assessment tasks that you undertake. Make a note of your personal areas of difficulty and develop a programme that will allow you to address each of these areas. This will guarantee a high-quality pass at the end of the year.

We wish you great success through the year.

2. Programme of formal assessment in Life Sciences

The table below shows the number and types of assessment tasks required in the Grade 12 year.

Formal, recorded, school-based assessment			Trial (Preliminary) examination
Content	Practical		Two written examination papers (2½ hours + 2½ hours)
<ul style="list-style-type: none"> • Three tests • (minimum of 50 marks each) • One June examination • (2½ hours, 150 marks) • One trial examination • (2 x 2½ hours, 150 marks each) • One project/assignment • (can be done in any term but recorded in Term 3: 100 marks) 	<ul style="list-style-type: none"> • 3 practical tasks • Practical tasks must cover the range of skills under SA 2. • Marks per practical task should be between 20 and 40. 		<ul style="list-style-type: none"> • 1 trial (preliminary) examination – 2 x 2½ hours, 150 marks each <p>This examination must test:</p> <ul style="list-style-type: none"> • Knowledge of content, concepts and skills across all topics • Knowledge of practical work as well as some of the skills related to practical work • All work completed in Terms 1, 2 and 3 as well as the Grade 11 topic (Human impact on the environment) that is assessable in Grade 12
School-based assessment (during the year)			
Term 1	Term 2	Term 3 and Term 4	
<ul style="list-style-type: none"> • One test • One practical task 	<ul style="list-style-type: none"> • One test • One practical task • June exam 	<ul style="list-style-type: none"> • One test • One practical task • 1 project or assignment 	
33%	33%	33%	
Convert to 50%			50%
SBA Total: 100			

NOTE: The SBA mark must be converted to 25% and the external examination counts 75% of the final mark.

A description of the requirements for each of the different types of assessment tasks follows below.

2.1 Practical tasks

When designing the practical tasks, the Life Sciences teacher must ensure that:

- All 7 skills under Specific Aim 2 listed below are covered over the three practical tasks:
 1. Follow instructions
 2. Handle equipment or apparatus
 3. Make observations
 4. Record information or data
 5. Measure accurately
 6. Interpret information
 7. Design/Plan an investigation
- At least ONE of the practical tasks includes manipulation of apparatus and/or collection of data.
- Any ONE practical task assesses at least 3 of the 7 skills and must include skill 6 and/or 7.
- 20–40 marks are allocated to a practical task.

2.2 Research project

A research project:

- Is a long-term task (at least 3 weeks of non-contact time)
- Has a maximum mark of 100
- Is an investigative task
- Focuses on accessing knowledge through literature research as well as through primary sources such as people
- Includes sub-skills such as:
 - Formulating investigative questions and hypotheses
 - Gathering information from a variety of sources
 - Manipulating and processing information
 - Analysing information
 - Identifying patterns
 - Evaluating data
 - Drawing valid conclusions
 - Communicating findings

2.3 Assignment

The assignment:

- Is a short-term task (1½–2 hours under controlled conditions)
- Has a maximum mark of 100
- Covers Specific Aims 1, 2 and 3
- Is completed at school and not at home
- Is completed without the use of any reference materials such as textbooks
- Is recorded in Term 3 even if it is given and assessed in Term 1 or Term 2
- Covers a variety of topics
- Includes as many as possible of the following:
 - Analysing and interpreting data
 - Making drawings
 - Plotting graphs
 - Drawing tables
 - Performing calculations
 - Justifying conclusions

2.4 Tests and Examinations

- The test is a minimum of 50 marks.
- The test in Term 1 covers all work done in that term.
- The tests in Term 2 and Term 3 cover at least half of the work covered in the respective terms.
- The mid-year examination covers work completed in Term 1 and Term 2.
- The trial examinations cover all work completed in Terms 1, 2 and 3, and must include the section on 'Human Impact' from Grade 11.

The following exemplars have been included in this publication:

Type of assessment task included in this publication	Number included in this publication	Number required in the Grade 12 year	Term in which assessment task is required
Assignment	2	1	Term 3
Practical task	2	3	Term 1, Term 2, Term 3 or 4
Test	1	3	Term 1, Term 2, Term 3 or 4

The exemplars provided are meant to show you the format of these tasks as well as the way in which the content and skills of each topic may be assessed.

3. Assessment tasks

3.1 Practical Task 1 – Surveying human characteristics

Topic	Genetics		
Specific aim(s)	SA 2	Type of activity	Individual
Marks	30	Duration	90 minutes







Task

Conduct a survey of the occurrence/frequency of dominant and recessive phenotypes for each of three traits/characteristics (as shown in the pictures below) among the learners in your school.

- This task must be done individually.
- This practical must be completed at school.

Background information

Many characteristics in humans are controlled by one gene with two alleles, one dominant and one recessive. Three examples are shown below.

					
Unattached earlobe	Attached earlobe	Tongue-roller	Non-roller	Straight thumb	Bent (hitch-hiker's) thumb
Dominant	Recessive	Dominant	Recessive	Dominant	Recessive

Method

1. Select 20 learners that will form part of your sample.
2. For every learner selected, record the phenotype for each characteristic.
3. Record the information for each learner in a table. At the end of the table, include the percentage of learners displaying each phenotype for each of the three characteristics.
4. Answer the questions set.

QUESTIONS

1. List any FOUR planning steps for this investigation. (4)
2. In terms of the investigation about the type of earlobe (free or attached), name the following:
 - 2.1 The dependent variable (1)
 - 2.2 The independent variable (1)
3. Formulate a hypothesis for the frequency of tongue-rollers as compared to non-rollers in your school. (3)
4. Construct a table to show the results obtained in this investigation. (4)
5. According to the results obtained, would you accept or reject the hypothesis formulated in QUESTION 3? (1)
6. State TWO ways in which you could make the results of this investigation more reliable. (2)
7. Using the same system of axes, draw a bar graph to represent the percentage of learners displaying each phenotype for each of the three characteristics. (8)
8. Use the symbols R (tongue-roller) and r (non-roller) to represent the phenotypes and genotypes of offspring resulting from a cross between two heterozygous individuals. (6)

[30]

3.2 Practical Task 2 – Simulating natural selection

Topic	Evolution		
Specific aim(s)	SA 2	Type of activity	Pair/ Individual
Marks	30	Duration	60 minutes

Task

Simulate 'natural selection' using a paper model.

- This task must be done in pairs but the questions must be answered individually.
- This practical must be completed at school.

Background information

A simulation allows one to demonstrate something that might sometimes be dangerous or that might sometimes require a lot of time, quickly and in a simple and safe way, using models.

The different parts that comprise the paper model in this task represent different components in nature. The sheet of newspaper and the sheet of white paper represent two different environmental conditions. The circles cut from white paper and from newspaper represent the different appearances/phenotypes of different individuals of the same species.

Aim

You are required to investigate the survival of the organisms with the two different phenotypes under different environmental conditions.

Materials required

- A sheet of white paper (preferably A3 size) to use as background
- A sheet of newspaper (cut to A3 size) to use as background
- Forceps/tweezers
- Clock with a second hand/stopwatch
- Scissors
- 30 x 2 cm diameter circles cut from another sheet of newspaper
- 30 x 2 cm diameter circles cut from another sheet of white paper
- Ruler

Method

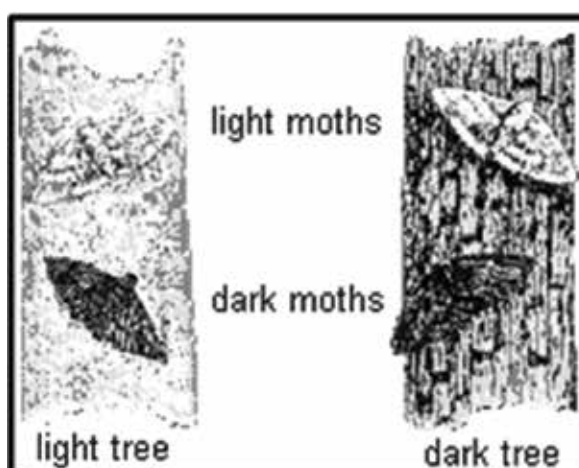
1. Place the sheet of white paper on the table.
2. Spread 30 white paper circles and 30 newspaper circles randomly over the surface of the white paper.
3. Ask your partner to use a pair of forceps/tweezers to pick up as many circles as he/she can in a period of 15 seconds.
4. Count the number of each type of circle that has been picked up. Record this in the table provided.
5. Now repeat steps 1–4 using the sheet of newspaper instead of the sheet of white paper.

Question

1. Formulate a hypothesis for the above investigation when using the sheet of white paper as background. (3)
2. For this investigation, name:
 - 2.1 The dependent variable (1)
 - 2.2 The independent variable (1)
 - 2.3 Any TWO fixed variables (2)
3. Copy and record your results in the following table:

DIFFERENT BACKGROUNDS	STARTING POPULATION		NUMBER OF CIRCLES PICKED UP ON DIFFERENT BACKGROUNDS	
	White paper circles	Newspaper circles	White paper circles	Newspaper circles
White paper	30	30		
Newspaper	30	30		

4. Draw a bar graph on the same system of axes to represent the results of your investigation. (8)
5. Explain the difference in results obtained for the two types of circles when using the sheet of white paper. (3)
6. State ONE way in which you could improve the reliability of the results. (1)
7. State a conclusion for the above investigation when the newspaper was used as a background. (3)
8. Based on the results obtained, will you accept or reject the hypothesis you formulated in QUESTION 1? (1)
9. Explain how this investigation and the results of this investigation simulate natural selection as it occurs in the peppered moth. Use the picture below to help you make a comparison. (5)



[30]

3.3 Assignment 1 – Response to the environment

Topic	Response to the environment		
Specific aim(s)	SA 1, SA 2, SA 3	Type of activity	Individual
Marks	100	Duration	90 minutes

Instructions and information

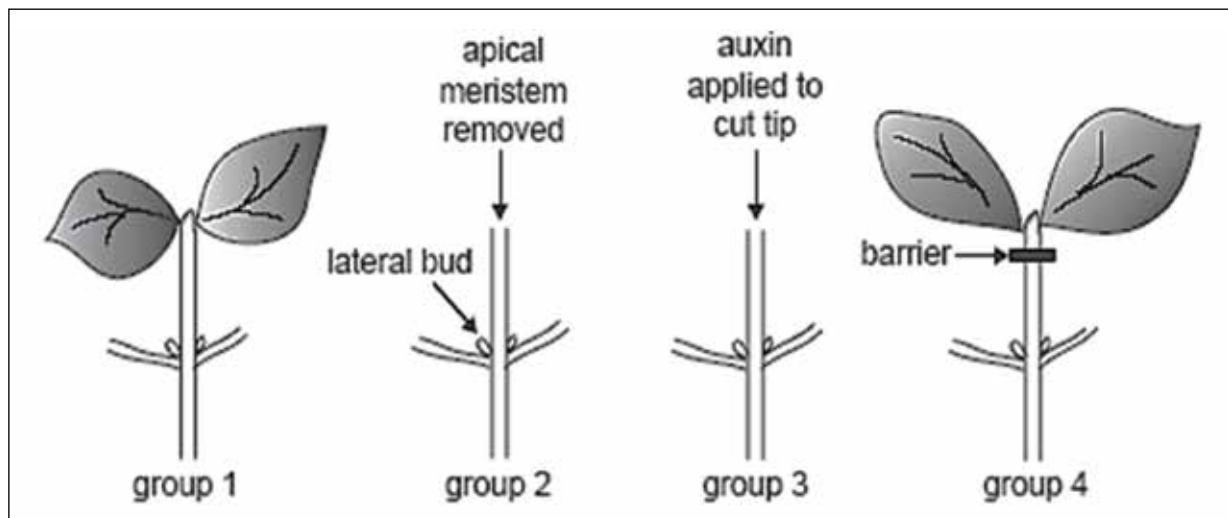
1. Answer ALL questions.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Draw diagrams and flow charts ONLY when requested to do so.
4. This assignment is to be done under controlled conditions and must be handed in at the end of the session.

NOTE: If it is not possible to schedule a single 90-minute session for this assignment, then SECTION A can be done on one day in a 45-minute session and SECTION B the following day in another 45-minute session.

SECTION A

QUESTION 1

An investigation was conducted to study apical dominance in bean plants. Four groups of plants were used. The diagram below illustrates the process.



The results are shown in the table below.

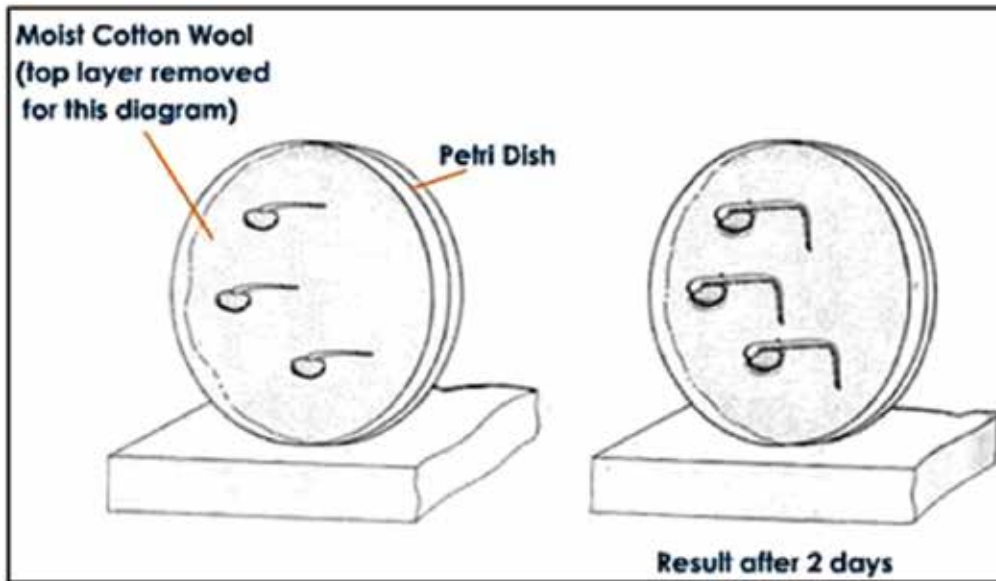
	Group 1	Group 2	Group 3	Group 4
Treatment given	Untreated	Apical meristem removed	Apical meristem removed and auxin applied to the cut tip	Apical meristem intact but a barrier to the movement of substances was placed under the tip
Response to treatment given	Growth of apical meristem but not of lateral buds	Growth of lateral buds	No growth of lateral buds	Growth of lateral buds

- 1.1 For this investigation, state the:
- 1.1.1 Independent variable (1)
 - 1.1.2 Dependent variable (1)
 - 1.1.3 Any TWO fixed variables (2)
- 1.2 Formulate a possible hypothesis for the above investigation. (3)
- 1.3 Explain the difference in results for Groups 3 and 4. (4)
- 1.4 Do the results allow you to accept or reject the hypothesis you formulated in QUESTION 1.2? (1)

[12]

QUESTION 2

The diagrams below show some stages in an investigation involving germinating bean seeds, kept in an evenly warm, damp environment.



- 2.1 What physical stimulus leads to the response above? (1)
- 2.2 Using the information in the diagram and your own knowledge, describe how the tip of the root grows in the direction that it does after two days. (6)
- 2.3 State TWO functions (other than growth movements and apical dominance) of the hormone responsible for the growth movement illustrated above. (2)
- 2.4 Will the same results be obtained if the investigation is carried out in a dark cupboard? (1)
- 2.5 Explain your answer to QUESTION 2.4. (2)
- 2.6 Explain why the cotton wool was kept moist. (2)

[14]

QUESTION 3

Read the passage below and answer the questions that follow.

DIABETES MELLITUS

Diabetes mellitus is a disorder relating to the role of insulin. There are two forms of the condition: insulin-dependent diabetes (IDDM) and a non-insulin dependent form (NIDDM).

IDDM accounts for about 15% of patients and usually develops before the age of 20. The condition arises when the body's immune system starts to attack the specific pancreas cells that make insulin. These patients can be treated with insulin injections.

NIDDM occurs in older people. They have normal and even above normal levels of insulin, but the cells that would normally respond become less sensitive to insulin. Therapy in this case involves correct diet and regular exercise.

One method used to determine if a person is diabetic is an oral glucose tolerance test. This involves giving the patient a drink containing 75 g glucose in 300 cm³ water after fasting (no food for 24 hours). Blood glucose is tested regularly for at least two hours. If the readings are above 200 mg/100 ml up to two hours later, the patient is diagnosed as being diabetic.

The normal plasma glucose level is 100 mg/100 ml. The glucose tolerance test was conducted for three adults and the plasma glucose level (mg/100 ml) was recorded for two hours at 30-minute intervals. The results are shown below.

Time (minutes)		0	30	60	90	120
Plasma glucose levels (mg/100 ml)	Adult 1	85	125	100	85	80
	Adult 2	130	215	250	260	240
	Adult 3	100	210	180	170	160

- 3.1 State how the glucose tolerance response test above is used to decide if a person is suffering from diabetes. (2)
- 3.2 Adult 1 is not diabetic.
- 3.2.1 Describe the changes expected in insulin secretion in Adult 1 during the period 30 minutes to 90 minutes after the glucose drink.
- 3.2.2 Explain your answer to QUESTION 3.2.1. (2)
- 3.3 Draw two line graphs on the same set of axes to show the glucose tolerance of Adults 1 and 2. (9)
- 3.4 What was the percentage increase in glucose level when the glucose was at its maximum in Adult 2? Show all working. (3)
- 3.5 Write down the plasma glucose level of the three adults after two hours as a ratio in simple whole numbers. Show all working. (2)
- 3.6 Suggest, with reasons, what would happen to insulin secretion for Adult 2:
- 3.6.1 If the condition was IDDM (2)
- 3.6.2 If the condition was NIDDM (2)

[24]

TOTAL SECTION A: 50

SECTION B

QUESTION 4

Read the passage and information below and answer the questions that follow.

STIMULUS AND RESPONSE

The eagle and the rabbit are dependent for their survival on their nervous system response rate. Their eye, ear and skin sensors send messages along sensory neurons to the central nervous system. The message is transferred by interneurons to provide a response along motor neurons demanding that the muscles move quickly.

Two learners conducted an investigation in the following way to determine which sense organ sends the message fastest to the brain: the eye, the ear or the skin (sight, hearing, or touch):

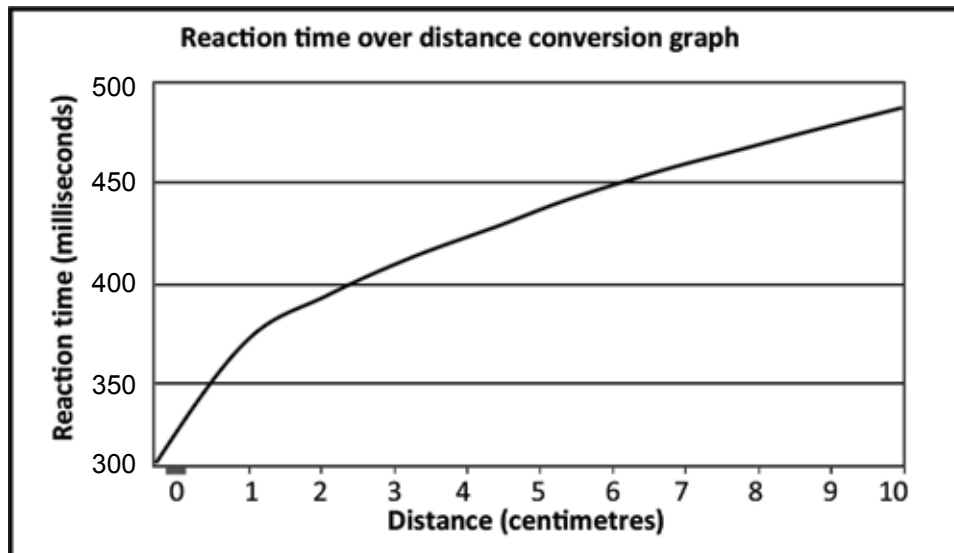
1. Vusi held a meter stick between his thumb and index finger just above the 100 cm mark, while Mary placed her thumb and forefinger at the 0 mark on both sides of the stick with just the thumb touching it.
2. As Vusi dropped the meter stick Mary attempted to catch it by closing her thumb and forefinger. The distance on the meter stick that the stick fell before Mary caught it was recorded and the procedure was repeated three times.
3. They repeated the investigation to determine hearing and skin responses. For the hearing response, Mary was blindfolded and reacted to Vusi shouting 'DROP' when he let go of the stick. For the skin response, Mary was blindfolded again. Vusi tapped Mary's free hand when he let go of the stick.

The results they obtained are shown in the following table:

Trial number	Distance on meter stick (cm)		
	Sight	Hearing	Touch
1	2	5	10
2	3	6	8
3	2	6	9
Average distance (cm)	2,3	X	9

- 4.1 Name the path that is described in the passage. (2)
- 4.2 In relation to this path, what term is used to describe each of the following in terms of the role they play?
 - 4.2.1 The muscles (1)
 - 4.2.2 Skin sensors (1)
- 4.3 Why should you advise the two learners to repeat the procedure more than three times for each investigation? (2)

- 4.4 Identify the following in their investigation: (1)
- 4.4.1 The dependent variable (1)
- 4.4.2 The independent variable (3)
- 4.5 Calculate the average distance that the meter stick fell when doing the 'hearing' investigation. Show all working.
- 4.6 Study the graph below showing how the distance on the meter stick can be converted to reaction time in milliseconds.



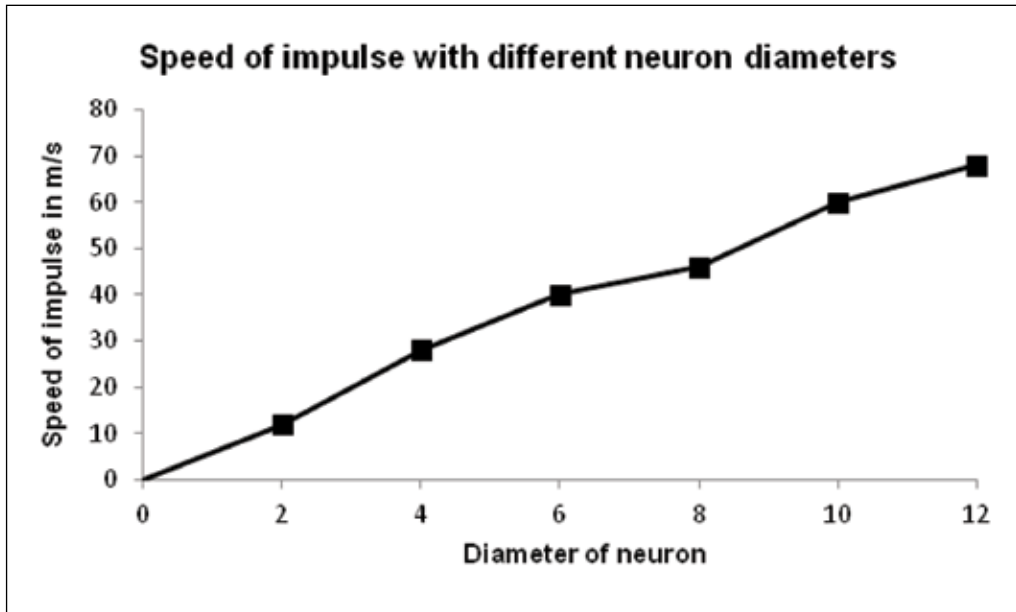
Use the reaction time over distance conversion graph to determine:

- 4.6.1 The actual reaction time if the meter stick dropped 9 centimetres (2)
- 4.6.2 The distance the ruler will drop for a reaction time of 400 milliseconds (2)

[15]

QUESTION 5

The graph shows the speed of a nerve impulse along neurons with different diameters, measured in micrometres (μm).



- 5.1 Describe the relationship between the diameter of a neuron and the speed of an impulse travelling along the neuron. (2)
- 5.2 Use the graph to estimate how fast an impulse would travel along a neuron with a diameter of 5 μm . (2)
- 5.3 Name the functional gap found between two neurons across which impulses are transmitted. (1)
- 5.4 Explain the significance of the myelin sheath that covers the neurons. (2)
- 5.5 Draw a diagram to illustrate the structure of a motor neuron. Indicate the direction of the impulse by means of an arrow in the diagram. (7)

[14]

QUESTION 6

A person sitting in a darkened room covers one eye. A dim electric bulb, positioned at varying distances from the person, is switched on at one-minute intervals for a period of 9 seconds. During this period the diameter of the pupil of the eye is measured. The results obtained are shown in the table below. Study the table and answer the questions that follow.

Time interval	1	2	3	4	5	6	7	8	9
Diameter of pupil (mm)	2	4	5	5	8	7	3	1	6

- 6.1 Name the structure in the eye that controls the size of the pupil. (1)
- 6.2 Between which TWO time intervals did the following changes in the diameter of the pupil occur?
- 6.2.1 Smallest increase (2)
- 6.2.2 Biggest decrease (2)
- 6.3 State why the size of the pupil changes from interval 8 to interval 9. (2)
- 6.4 Describe how the size of the pupil changes from interval 8 to interval 9. (4)
- 6.5 Why is the response in QUESTION 6.3 referred to as a 'reflex'? (1)
- 6.6 What is the significance of this reflex? (1)
- 6.7 At which time interval was the bulb the furthest from the eye? (1)
- 6.8 Explain your answer to QUESTION 6.7. (2)
- 6.9 State TWO ways in which the investigator could ensure that the results of this investigation are reliable. (2)
- 6.10 State THREE things that must be kept constant in this investigation to ensure that it is valid. (3)

[21]

TOTAL SECTION B: 50

GRAND TOTAL: 100

3.4 Assignment 2 – Reproduction

Topic	Reproduction		
Specific aim(s)	SA 1, SA 2, SA 3	Type of activity	Individual
Marks	100	Duration	90 minutes

Instructions and information

1. Answer ALL questions.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Draw diagrams and flow charts ONLY when requested to do so.
4. This assignment is to be done under controlled conditions and must be handed in at the end of the session.

NOTE: If it is not possible to schedule a single 90-minute session for this assignment, then SECTION A can be done on one day in a 45-minute session and SECTION B the following day in another 45-minute session.

SECTION A

QUESTION 1

Read the text below and then answer the questions that follow.

REPRODUCTIVE STRATEGIES OF THE BULLFROG

Most amphibians spend at least part of their lives in moist surroundings, and their fragile, jelly-like eggs are usually laid in water.

In mating and feeding, amphibians are active at night. The courtship call of the bullfrog attracts females for mating. During mating, the female bullfrog deposits as many as 10 000 eggs into the water and the male simultaneously releases sperm. Fertilisation occurs externally.

The eggs of most species of bullfrog hatch into tadpoles in 3–5 days. Tadpoles breathe through gills and metamorphose into air-breathing adults with lungs. Laying eggs in water prevents drying out and makes it easier for the frog sperm to reach the eggs.

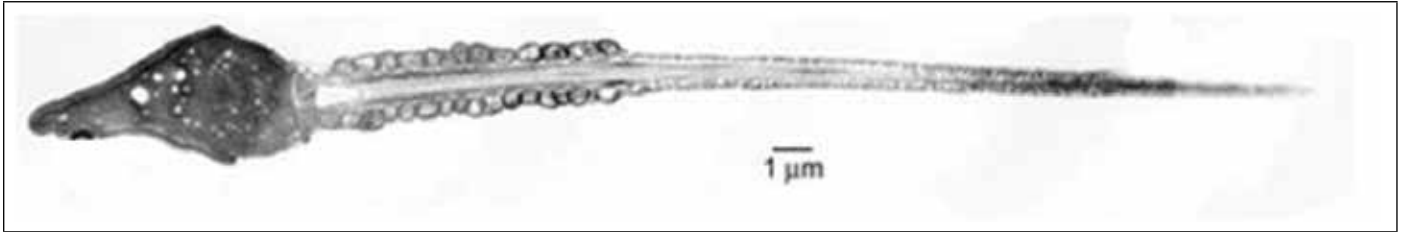
Amphibian eggs appear as small black spots in a gelatinous mass and receive little or no parental protection. Large numbers of eggs are produced because many are eaten and changes in the environmental moisture cause many to dehydrate and die. Nearby plant matter shelters the hatching tadpoles.

- 1.1 State the type of fertilisation (external or internal) that occurs in bullfrogs and describe how it occurs. (3)
- 1.2 State whether reproduction in bullfrogs is viviparous, oviparous or ovoviviparous. (1)
- 1.3 Explain your answer to QUESTION 1.2. (2)
- 1.4 Describe TWO characteristics of a frog's egg. (2)
- 1.5 Give TWO reasons suggested in the article for bullfrog eggs to be laid in water. (2)
- 1.6 Frog eggs are vulnerable to predators, since there is little or no parental protection.
Explain THREE strategies that ensure a good survival rate of tadpoles. (6)

[16]

QUESTION 2

The electron micrograph below is that of the human sperm. Study the micrograph and answer the questions that follow.



- 2.1 Draw a labelled line diagram of the human sperm represented in the electron micrograph. (6)
- 2.2 Use the scale line provided to calculate the width of the sperm at its widest point. (4)
- 2.3 Explain THREE ways in which the sperm is structurally suited for its role in fertilisation. (6)

[16]

QUESTION 3

Records of human fertility for the period 1941 to 1990 have shown changes in the sperm counts of normal men. The table below summarises the changing percentages of men with high or low sperm counts over a period of 50 years.

TIME PERIOD	MEN WITH HIGH SPERM COUNTS (%)	MEN WITH LOW SPERM COUNTS (%)
1941–1950	50	4
1951–1960	45	5
1961–1970	28	11
1971–1980	21	14
1981–1990	15	18

- 3.1 During which time period was there:
 - 3.1.1 The highest percentage of men with low sperm counts? (1)
 - 3.1.2 The lowest percentage of men with high sperm counts? (1)
 - 3.1.3 The greatest difference between men with high sperm counts and men with low sperm counts? (1)
- 3.2 Describe the trend for men with low sperm counts, and compare it with those with high sperm counts over the period of 50 years. (2)
- 3.3 Calculate the percentage increase in men with low sperm counts from 1971 to 1990. (2)
- 3.4 Suggest TWO reasons for the trend described in QUESTION 3.2. (2)

[9]

QUESTION 4

The table below shows the results of a survey on the use of contraceptives by a sample of women in a rural area.

CONTRACEPTIVE	NUMBER OF WOMEN
Sterilisation	34
Pill	38
Condom	22
Rhythm method	30
None	76
TOTAL	200

Draw a pie chart to show the results of the survey. Show all working.

[9]

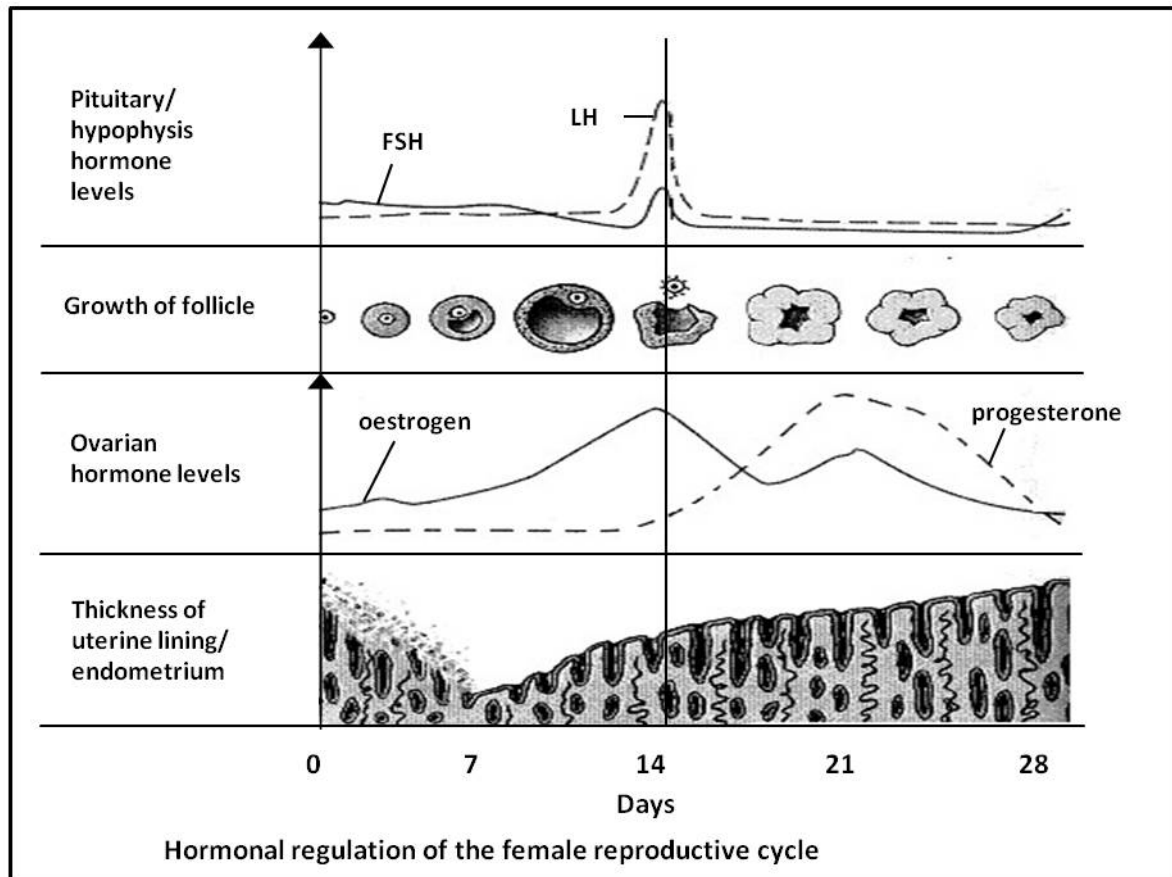
TOTAL SECTION A:

50

SECTION B

QUESTION 5

The diagram below shows the changes in the ovary, uterus and level of hormones during a 28-day menstrual cycle. Study the diagram and answer the questions that follow.



- 5.1 Which hormone is responsible for:
- 5.1.1 Ovulation (1)
- 5.1.2 Primary (first) thickening of the endometrium (1)
- 5.2 According to the graph, on which day(s) does each of the following occur:
- 5.2.1 Menstruation (1)
- 5.2.2 Ovulation (1)
- 5.3 Two structures in the ovaries are responsible for the secretion of two female hormones.
- 5.3.1 Name the TWO structures and the hormones they secrete. (4)
- 5.3.2 Give evidence from the graph to support your answer to QUESTION 5.3.1. (4)
- 5.4 Explain the interaction that occurs between the hormones FSH and progesterone and why it is necessary. (3)
- 5.5 Is the female, whose cycle is represented in the diagram, pregnant? (1)
- 5.6 Give TWO reasons from the graph for your answer to QUESTION 5.5. (2)

[18]

QUESTION 6

The table below shows the average human foetal length of males and females over a 40-week gestation period.

Time (weeks)	Foetal length (cm)	
	Male	Female
8	1	1
13	7	7
16	14	13
24	33	31
36	46	43
40	51	49

- 6.1 Draw TWO sets of bar graphs on the same system of axes to compare male and female foetal length over time. (9)
- 6.2 State TWO conclusions that could be drawn from the results in the graph. (4)
- [13]**

QUESTION 7

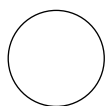
John and Mary have two children. The oldest is Patrick, followed by Anne, a girl. Mary is pregnant again.

7.1 By representing a genetic cross, show the percentage probability of them having another daughter. (7)

7.2 Mary and John's first child is a haemophiliac and they are afraid that their third child may also have the disorder. Mary is a carrier of haemophilia and John has the normal clotting factor. An ultrasound scan shows that Mary is expecting a girl.

Show, using a genetic cross, the percentage probability of their third child having haemophilia. (7)

7.3 Use the following symbols to construct a simple pedigree diagram showing the inheritance of haemophilia in this family:



Unaffected female
(no haemophilia)



Unaffected male
(no haemophilia)



Affected female
(has haemophilia)



Affected male
(has haemophilia)

(5)
[19]

TOTAL SECTION B: 50

3.5 Test – Nucleic acids and meiosis

Topic	Nucleic acids and meiosis		
Specific aim(s)	SA 1, SA 3	Type of activity	Individual
Marks	50	Duration	60 minutes

Instructions and information

1. Answer ALL questions.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Draw diagrams and flow charts ONLY when requested to do so.
4. This test is to be done under controlled conditions and must be handed in at the end of the session.

SECTION A

QUESTION 1

1.1 Various possible options are provided as answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

1.1.1 All nucleic acids are made up of ...

- A deoxyribose sugars, nitrogenous bases and phosphates.
- B sugars, nitrogenous bases and phosphates.
- C ribose sugars, nitrogenous bases and phosphates.
- D sugars, nitrogenous bases and sulphates.

1.1.2 If a DNA molecule contains 20 000 base molecules, of which 20% are cytosine, how many adenine molecules will be present?

- A 1 000
- B 2 000
- C 6 000
- D 8 000

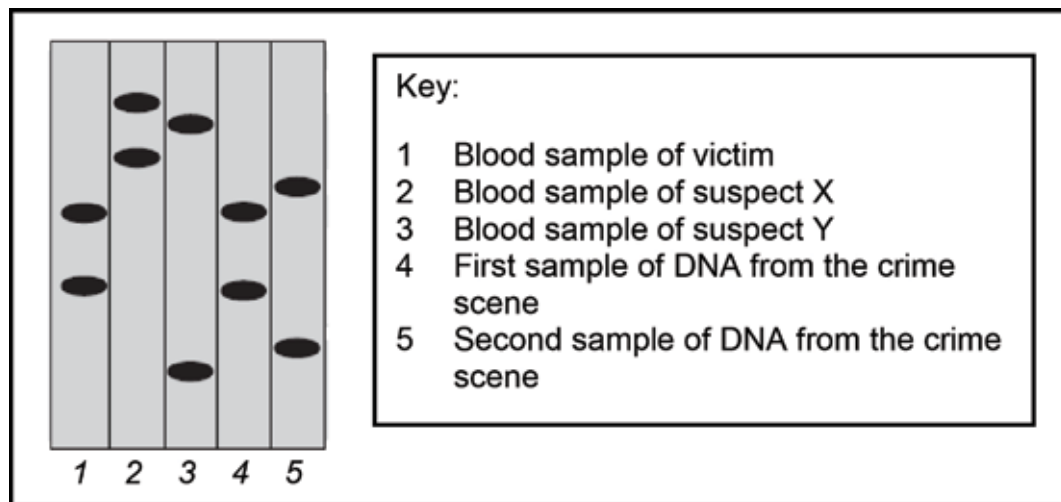
1.1.3 DNA replication ensures that all daughter cells formed as a result of ...

- A mitosis, have identical genetic material.
- B meiosis, have identical genetic material.
- C mitosis, have half the number of chromosomes as the parent cell.
- D meiosis, have half the number of chromosomes as the parent cell.

1.1.4 In individuals with normal haemoglobin, the mRNA for haemoglobin includes the codon GAA. This sequence is changed in individuals with sickle cell anaemia so that their mRNA has a codon GUA at the same location. This suggests that the DNA has undergone a mutation involving a change of base sequence from ...

- A CAA to TAA.
- B CTT to CAT.
- C CUU to CAT.
- D CTT to CTA.

1.1.5 The result of profiling various DNA samples in a criminal investigation is shown below.



Which conclusion about the crime could the DNA analyst draw?

- A Only suspect X was involved.
- B Only suspect Y was involved.
- C Suspects X and Y were both involved.
- D Neither suspect X nor suspect Y was involved. (5 x 2) (10)

1.2 Give the correct biological term for each of the following descriptions. Write only the term next to the question number (1.2.1–1.2.4) in the ANSWER BOOK.

1.2.1 Specific lengths of DNA which carry codes for specific characteristics of organisms

1.2.2 The part of protein synthesis taking place in the nucleus

1.2.3 The bonds between the two strands of a DNA molecule

1.2.4 The chromosome condition/ploidy of a somatic cell (4)

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 (1.3.1–1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Chromatids separate and move to the poles.	A:	Anaphase I
		B:	Anaphase II
1.3.2	The strand of DNA that provides the code during replication.	A:	Template
		B:	Complementary strand
1.3.3	Contain bases that are complementary to that of DNA.	A:	Codon
		B:	Anticodon

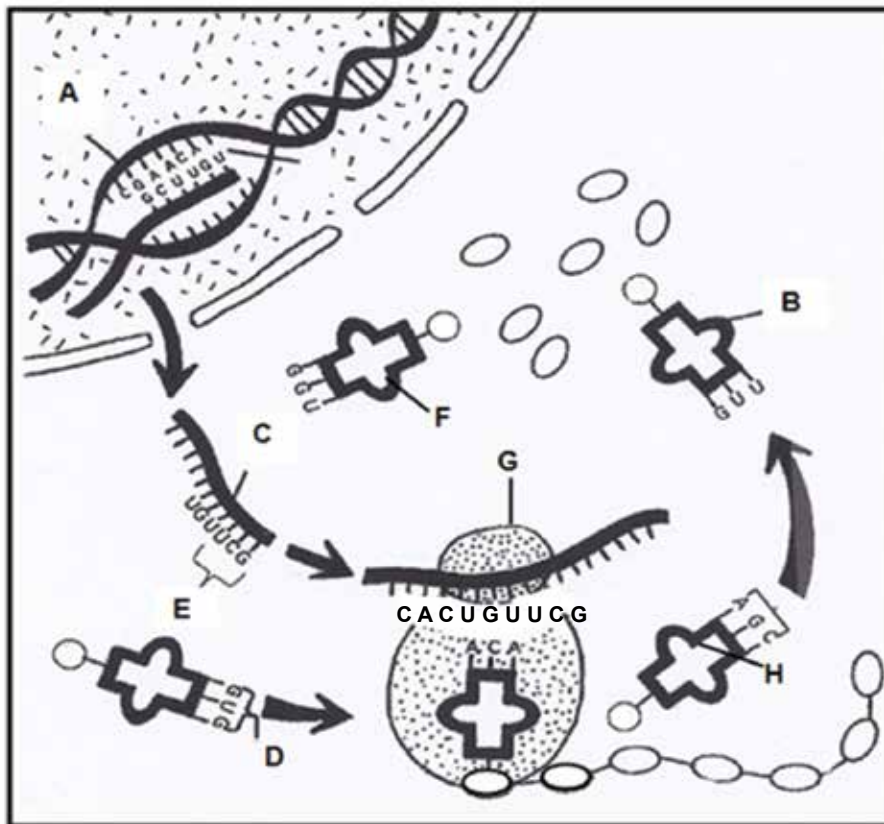
(3 x 2) (6)

TOTAL SECTION A: 20

SECTION B

QUESTION 2

Study the diagram below showing a process that takes place in all living cells.



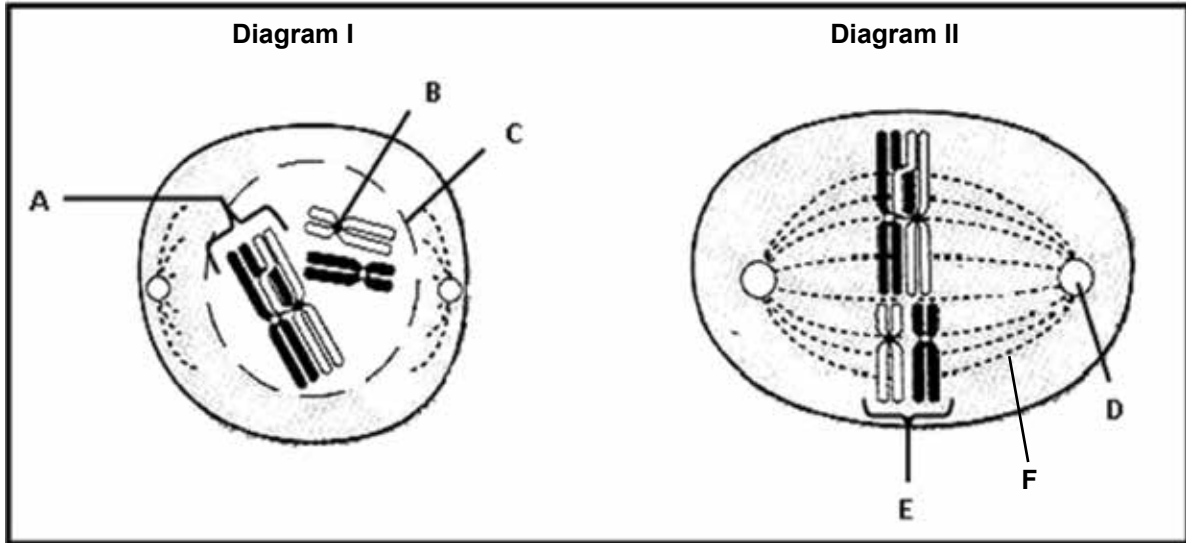
- 2.1 Identify the process represented in the above diagram. (1)
- 2.2 Name the specific part of the process mentioned in QUESTION 2.1 that occur at the organelle labelled **G**. (1)
- 2.3 Describe the process named in answer to QUESTION 2.2. (5)
- 2.4 State TWO similarities in structure between molecules **B** and **C**. (2)
- 2.5 The table below indicates the amino acids that are carried by different tRNAs.

tRNA BASES	AMINO ACID	tRNA BASES	AMINO ACID	tRNA BASES	AMINO ACID
GUU	Glutamine	CUA	Aspartate	GAU	Leucine
GCG	Arginine	GGU	Proline	UAU	Isoleucine
CCG	Glycine	ACA	Cysteine	GUG	Histidine
CUU	Glutamate	AGC	Serine	ACC	Tryptophan

- Identify the amino acids which will be brought to **organelle G** according to the code provided by the mRNA found on **G**. (3)
- 2.6 Write down the triplet of DNA bases that correspond to each of the molecules **B**, **F** and **H**, respectively. (3)

QUESTION 3

Study the diagrams below that represent different phases of Meiosis I.



- 3.1 Identify the structures labelled **B** and **E**. (2)
- 3.2 State TWO functions of the structure labelled **F**. (2)
- 3.3 Describe the process shown at **A** in Diagram I. (2)
- 3.4 Tabulate TWO ways in which a cell in the phase shown in Diagram II would differ from a cell in the same phase in Meiosis II. (5)
- 3.5 How many chromosomes will be present in each cell at the end of meiosis? (1)
- 3.6 If the above cell division occurred in a human being, describe the events leading to the formation of an offspring with Down syndrome. (3)

[15]

TOTAL SECTION B: 30

GRAND TOTAL: 50

