



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## NATIONAL SENIOR CERTIFICATE

**GRADE 12**

**LIFE SCIENCES P1**

**VERSION 2 (OLD CONTENT) FOR PART-TIME CANDIDATES**

**FEBRUARY/MARCH 2013**

**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 the ANSWER BOOK.
3. Start the answer to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbers used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Only draw diagrams or flow charts when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. You may NOT use graph paper.
10. You must use a non-programmable calculator, protractor and 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 1.1.6) in the ANSWER BOOK, for example 1.1.7 D.

1.1.1 A ring of bacterial DNA that is found in addition to the organism's main DNA is known as a ...

- A protein.
- B plasmid.
- C mutation.
- D triplet.

1.1.2 Which of the following statements are characteristic of DNA?

- (i) Double helix
- (ii) Sugar molecule is deoxyribose
- (iii) Found in the nucleus
- (iv) Constant amount normally found in all the somatic cells of a particular species

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

1.1.3 If an analysis of DNA from cells in a human body showed that adenine made up 15% of the nucleotide bases, the percentage composition of cytosine in the DNA would be ...

- A 15.
- B 70.
- C 30.
- D 35.

1.1.4 The relationship between nucleic acids and nucleotides is that ...

- A nucleotides are building blocks of nucleic acids.
- B nucleic acids are building blocks of nucleotides.
- C nucleotides are larger than nucleic acids.
- D nucleic acids are found in the nucleus and nucleotides are found in the cytoplasm.

1.1.5 The probability that two parents who are heterozygous for an inherited trait will have a homozygous dominant offspring is ...%.

- A 33
- B 50
- C 25
- D 100

1.1.6 In the development of the human embryo, the purpose of the amnion is to ...

- A serve as a reserve food supply.
- B enclose a fluid that protects the embryo against injury.
- C give rise to the placenta.
- D prevent the developing foetus from moving about. (6 x 2)

(12)

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 the ANSWER BOOK.

1.2.1 A genetic disorder in which the person lacks the ability to produce the dark pigment in the skin, melanin

1.2.2 The process whereby the DNA molecule makes a copy of itself

1.2.3 The duct/tube carrying ova from the ovaries to the uterus in females

1.2.4 A pair of chromosomes, one inherited from each parent, that have the same genes at the same loci

1.2.5 Two identical alleles for a particular characteristic

1.2.6 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell

1.2.7 The physical and functional expression of a gene

1.2.8 An allele that is not expressed when found in the heterozygous condition

(8)

- 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 relevant question number (1.3.1 to 1.3.7) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Result of fertilisation in angiosperm plants	A: Zygote B: Endosperm tissue
1.3.2	Method of contraception	A: Vasectomy B: The rhythm method
1.3.3	Red flowering plants crossed with white flowering plants produce a plant with flowers that have patches of red and patches of white	A: Codominance B: Complete dominance
1.3.4	Receives pollen grains	A: Stigma B: Style
1.3.5	Structure of RNA	A: Guanine pairs with cytosine B: Contains deoxyribose sugar
1.3.6	Forms the seed after fertilisation in angiosperms	A: Ovary B: Ovule
1.3.7	Type of mutation where one nitrogenous base is substituted by another	A: Point mutation B: Frame-shift mutation

(7 x 2) (14)

- 1.4 The table below refers to human genetic disorders.

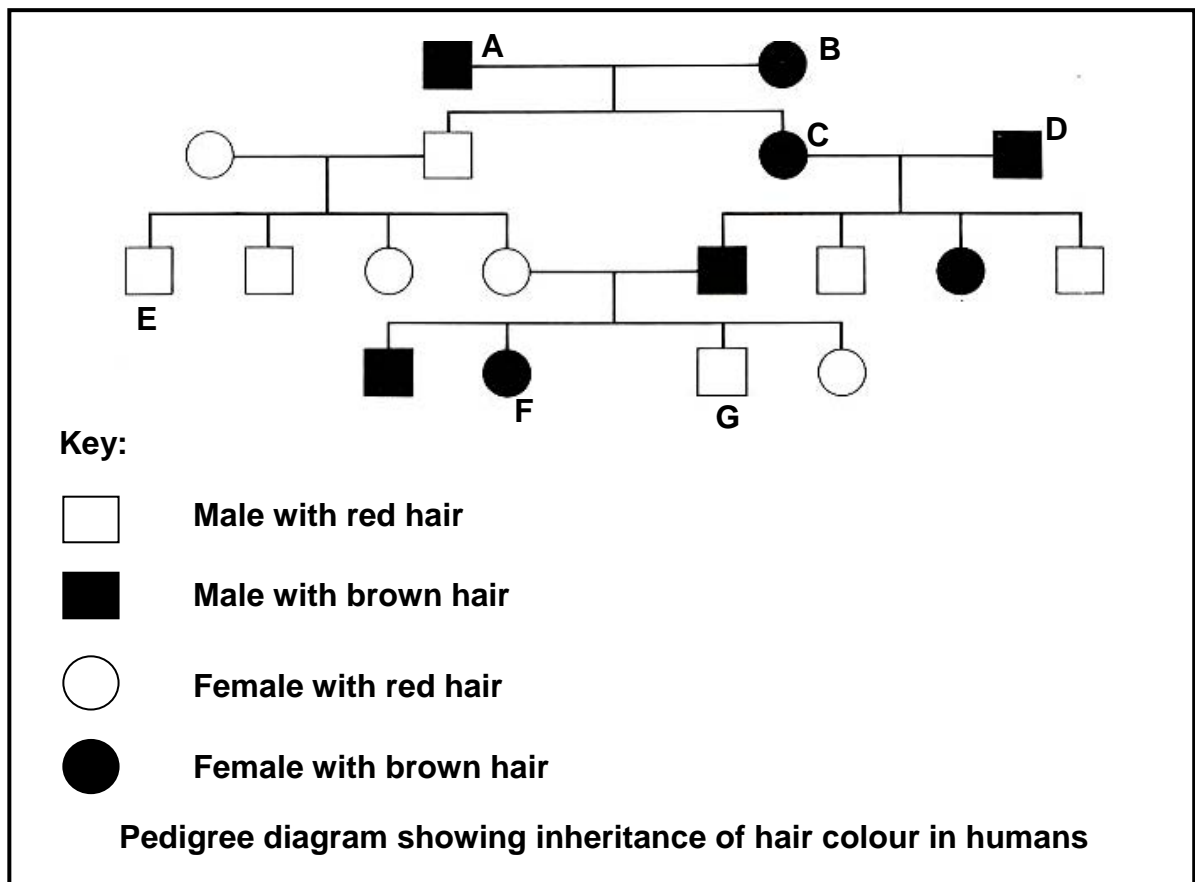
DISORDER	CAUSE	SYMPTOMS
(a)	Non-disjunction of chromosome pair 21 during meiosis	(b) State TWO symptoms.
Haemophilia	Recessive allele on a sex chromosome	(c)
(d)	(e)	Red blood cells with a reduced surface area/Deformed red blood cells

Write down the missing information to complete the table next to the letters (a) to (e) in the ANSWER BOOK.

(6)

- 1.5 The pedigree diagram below shows the inheritance of hair colour in humans. The colour of human hair is determined by a gene which has two alleles. The allele for brown hair (**B**) is dominant and the one for red hair (**b**) is recessive.

Study the pedigree diagram below and answer the questions which follow.



- 1.5.1 Name the phenotype (gender and hair colour) of **B**. (2)
- 1.5.2 Name ALL the possible genotypes of:
- (a) A (1)
  - (b) F (1)
  - (c) E (1)
- 1.5.3 (a) How many individuals in the pedigree diagram could be homozygous dominant? (1)
- (b) How many individuals in the pedigree diagram are homozygous recessive females? (1)
- 1.5.4 If parents **C** and **D** have another child, express in percentage what the chance is that:
- (a) The child is female (1)
  - (b) The child has brown hair (2)

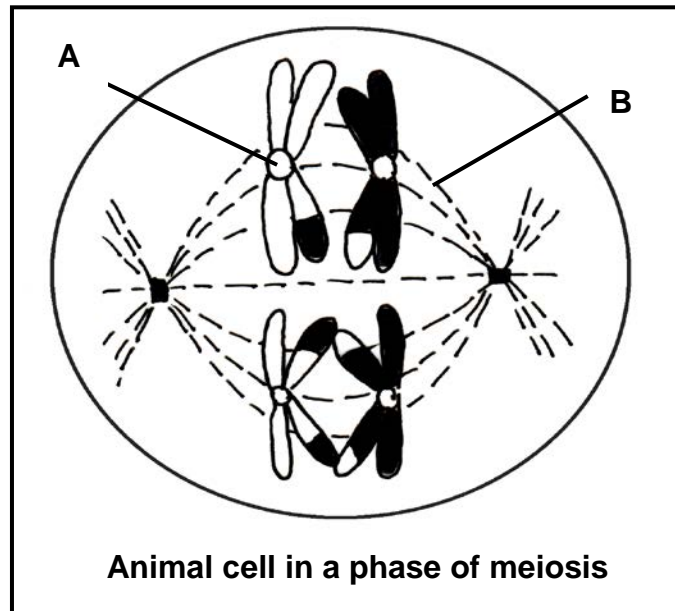
**(10)**

**TOTAL SECTION A: 50**

## SECTION B

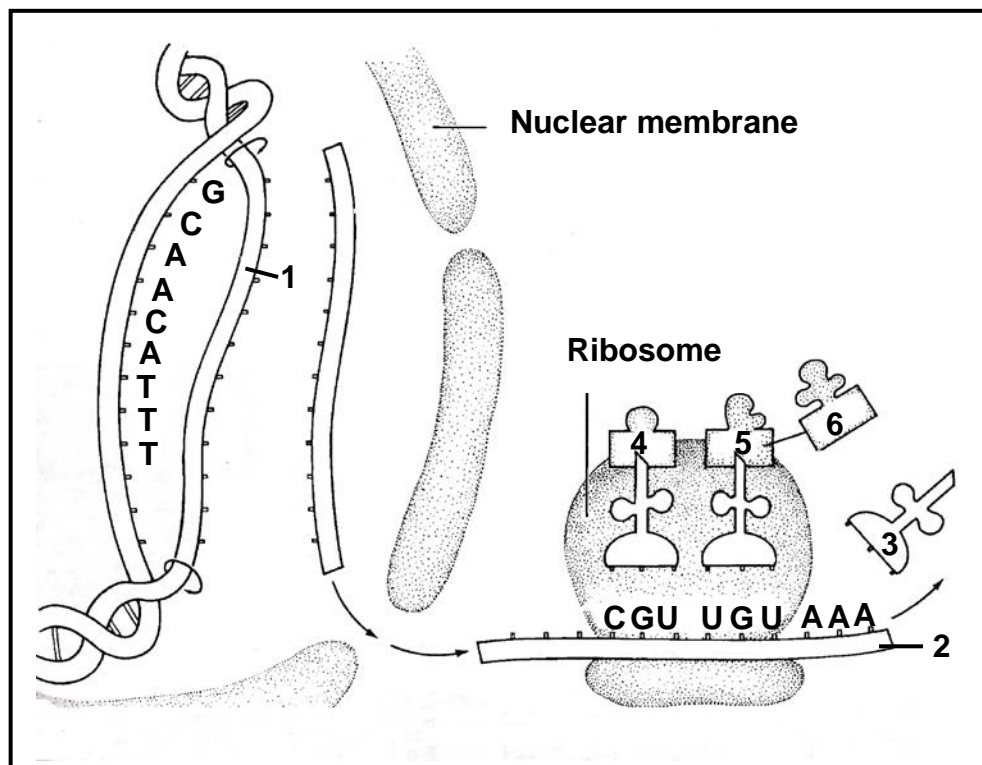
### QUESTION 2

2.1 The diagram below represents an animal cell in a phase of meiosis.



- 2.1.1 Identify the parts labelled **A** and **B**. (2)
- 2.1.2 State whether the phase of meiosis shown above is a part of Meiosis I or Meiosis II. (1)
- 2.1.3 Give ONE visible reason for your answer to QUESTION 2.1.2. (1)
- 2.1.4 Answer the following questions:
- (a) How many chromosomes are present in the cell above? (1)
- (b) How many chromosomes will be present in each cell at the end of meiosis? (1)
- 2.1.5 Could the cell represented in the diagram be that of a human? (1)
- 2.1.6 Explain your answer to QUESTION 2.1.5. (2)
- (9)**

- 2.2 Study the diagram illustrating protein synthesis below and answer the questions that follow.



- 2.2.1 Name the molecule labelled **2**. (1)
- 2.2.2 Using the letters of the genetic code, write down the complementary nitrogenous bases on strand 1 of the DNA double helix, starting from the top. (2)
- 2.2.3 The table below shows the base triplets of tRNA (anticodons) that correspond to the different amino acids.

Base triplets (anticodons) of tRNA that correspond to different amino acids	
tRNA anticodons	Amino acids
UGU	threoline
CGU	alanine
UUU	lysine
ACA	cysteine
GCA	arginine
GUU	glutamine
CUA	aspartate
CCA	glycine
AAA	phenylalanine



Answer the following questions using the diagram in QUESTION 2.2 and the table provided:

- (a) Write down the anticodon at **3**. (2)
  - (b) Name the amino acid at **5**. (2)
  - (c) Describe how the composition of the protein molecule would change if the base sequence of the first codon (from the left) of molecule 2 was UUU instead of CGU. (2)
- (9)**

2.3 The Human Sciences Research Council conducted a study of HIV/Aids prevalence and tested 8 428 people of different ages for HIV/Aids in 2002. The results are shown in the table below.

AGE (years)	NUMBER TESTED	HIV POSITIVE (%)	
		Male	Female
<b>2–4</b>	2 348	5,9	5,2
<b>15–24</b>	2 099	6,1	12,0
<b>25+</b>	3 981	14,1	16,2
<b>TOTAL</b>	<b>8 428</b>	<b>X</b>	<b>12,08</b>

- 2.3.1 Which age group has the highest proportion of HIV positive people? (1)
  - 2.3.2 Give ONE possible reason for your answer to QUESTION 2.3.1. (1)
  - 2.3.3 State the most likely way in which some of the children in the 2- to 4-year-old age group contracted HIV. (1)
  - 2.3.4 The following proposal was made to control the spread of HIV:  
  
All sexually active people should be compelled by law to get an HIV test. The results should be made available to anybody who needs this information.
    - (a) State THREE advantages of this proposal. (3)
    - (b) State THREE disadvantages of this proposal. (3)
  - 2.3.5 Calculate **X** in the table above. Show your working. (3)
- (12)**  
**[30]**

### QUESTION 3

3.1 A man of blood type A married a woman of blood type B. They had three children with blood types O, B and AB.

3.1.1 How many alleles control blood groups? (1)

3.1.2 Explain why blood groups are said to show both codominance and complete dominance. (4)

3.1.3 Show, with a representation of a genetic cross, the genotypes and phenotypes of the parents and children. (6)  
(11)

3.2 Two researchers, Zama and Previn, carried out separate investigations into the variation in the height of sunflower plants that were planted in a field on 8 March 2012.

Zama's procedure was as follows:

- The investigation was done on 14 April 2012.
- The sunflower plants were taken from 20 randomly selected areas.
- The sunflower plants that were measured were selected at random.
- The heights of 10 plants were measured in each of the selected areas.

Previn's procedure was as follows:

- The investigation was done on 24 April 2012.
- The sunflower plants were taken from 20 randomly selected areas.
- The sunflower plants that were measured were selected at random.
- The heights of 5 plants were measured in each of the selected areas.

The results of both Zama's and Previn's investigations are shown in the table below.

Height interval (cm)	Number of sunflower plants	
	Zama	Previn
51–55	25	15
56–60	45	20
61–70	40	30
71–75	55	25
76–80	35	10

3.2.1 Combine Zama's and Previn's results to determine the height interval that contains the largest number of sunflower plants. (1)

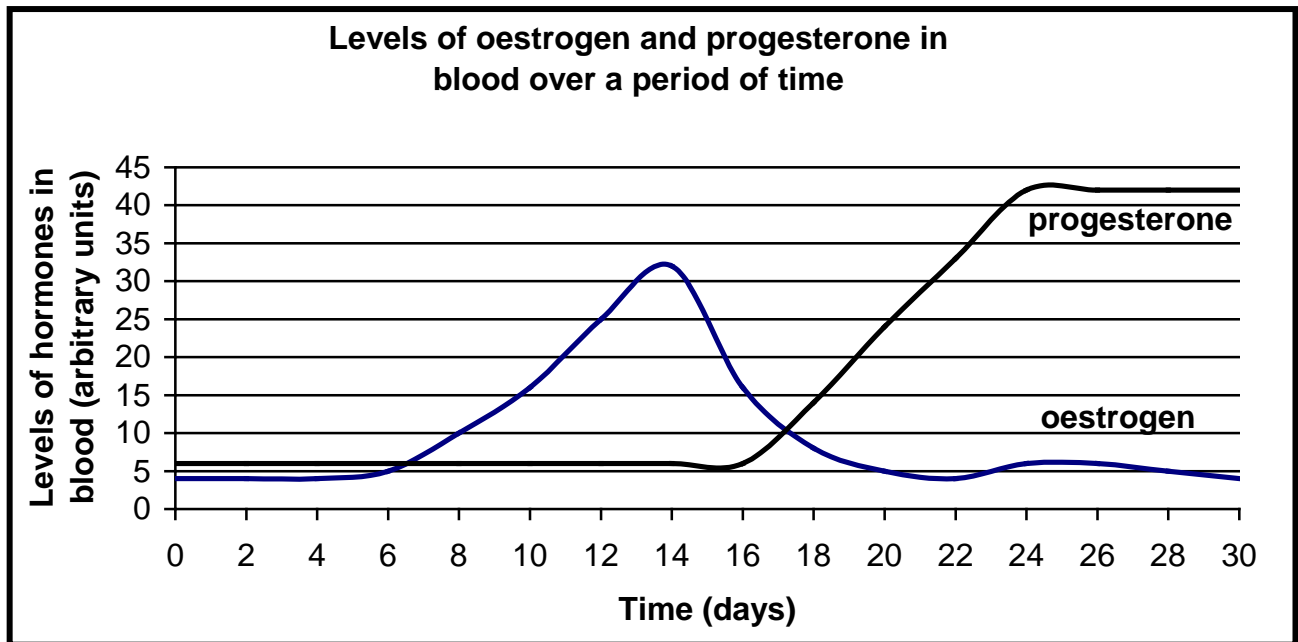
3.2.2 Explain why the plants were selected at random. (2)

- |                         |   |             |
|-------------------------|---|-------------|
| 3.2.3                   | Zama concluded that the variation in the height of sunflower plants is only due to genetics. Explain why this conclusion is probably wrong. | (2)         |
| 3.2.4                   | Whose results (Zama's or Previn's) are probably more reliable?  | (1)         |
| 3.2.5                   | Give a reason for your answer to QUESTION 3.2.4.  | (1)         |
| 3.2.6                   | State THREE ways in which the design of the investigation may be improved upon to increase validity and reliability of the procedure.       | (3)         |
| 3.2.7                   | Draw a histogram to illustrate Zama's results.  | (9)         |
|                         |   | <b>(19)</b> |
|                         |   | <b>[30]</b> |
| <b>TOTAL SECTION B:</b> |   | <b>60</b>   |

## SECTION C

### QUESTION 4

- 4.1 The graph below shows the levels of the hormones oestrogen and progesterone in a pregnant woman's blood.



4.1.1 When are the levels of oestrogen and progesterone the same? (2)

4.1.2 How much oestrogen is in the blood on day 14? (2)

4.1.3 What evidence from the graph shows that an ovum was fertilised? (2)  
(6)

4.2 Name TWO types of twins formed in humans and explain how each type is formed during fertilisation. (6)

- 4.3 Read the passage below describing a method used by fertility experts to assist women with fertility problems.

#### FERTILITY PROCEDURE

- The woman is given fertility drugs (containing hormones) that cause her ovaries to release many mature ova simultaneously.
- These ova are collected from the ovaries and then mixed with sperm in a petri dish which contains a fluid with salts and nutrients, and are kept at 37 °C.
- The ova are then observed under a microscope to see if cell division takes place. If cell division did take place, it means that fertilisation and zygote formation took place.
- After about three days, one or more of the dividing zygotes (now called embryos) are inserted into the woman's uterus. Usually one of the embryos becomes implanted and develops into a baby. Sometimes more than one embryo becomes implanted, occasionally resulting in multiple births.
- The success rate for in vitro fertilisation is about 20–30%.

- 4.3.1 Explain why a fertility expert would want many ova to develop in a woman's ovaries. (2)
- 4.3.2 Why must the petri dish and nutrients be kept at 37 °C? (1)
- 4.3.3 Explain why the embryos are inserted in the uterus after three days, and not before. (2)
- 4.3.4 Give TWO reasons why people might:
- (a) Support the use of in vitro fertilisation (4)
- (b) Be against the use of in vitro fertilisation (4)
- (13)**

- 4.4 The development of ultrasound and research into the use of stem cells from embryos and the placenta were intended to improve the quality of human life, but they have also had unintended consequences.

Write a mini essay in which you describe the advantages and disadvantages associated with the use of ultrasound and stem cells from human embryos.

Content: (12)  
Synthesis: (3)  
**(15)**

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