



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**LIFE SCIENCES P1  
FEBRUARY/MARCH 2010**

**MARKS: 150**

**TIME: 2½ hours**

**This question paper consists of 14 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 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 all drawn to scale.
9. Do NOT use graph paper.
10. Non-programmable calculators, protractors and compasses may be used.
11. Write neatly and legibly.

**SECTION A****QUESTION 1**

1.1 Various options are given 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 1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

1.1.1 In a flowering plant, the fruit develops from the ...

- A corolla.
- B anther.
- C calyx.
- D ovary.

1.1.2 Which of the following statements are characteristic of DNA?

- (i) Double-stranded helix
- (ii) Sugar 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 (ii), (iii) and (iv) only
- D (i), (ii), (iii) and (iv)

1.1.3 Menstruation starts when the production of ...

- A oestrogen and progesterone decreases.
- B oestrogen is at its maximum.
- C progesterone is at its maximum.
- D oxytocin decreases.

1.1.4 In a breeding experiment between a parent showing the dominant phenotype and a parent showing the recessive phenotype, the offspring showed equal proportions of the dominant and recessive phenotypes. Which ONE of the following statements is TRUE?

- A Both parents were heterozygous.
- B Both parents were homozygous.
- C Both parents carry at least one recessive gene.
- D Only one parent carried at least one recessive gene.

1.1.5 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.

(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 to 1.2.7) in the ANSWER BOOK.

1.2.1 The period of development of an embryo in the uterus between fertilisation and birth

1.2.2 The structure formed from the Graafian follicle after ovulation

1.2.3 The structure containing enzymes at the tip of a sperm cell that makes contact with the egg cell during fertilisation

1.2.4 The transfer of pollen from anthers to a stigma

1.2.5 A genetic cross involving two characteristics at a time

1.2.6 The process of finding a desirable gene, isolating it and then moving it into the cells of another organism

1.2.7 The process by which amniotic fluid is drawn out of the uterus and examined to determine whether the unborn baby has a genetic disorder

(7 x 1) (7)

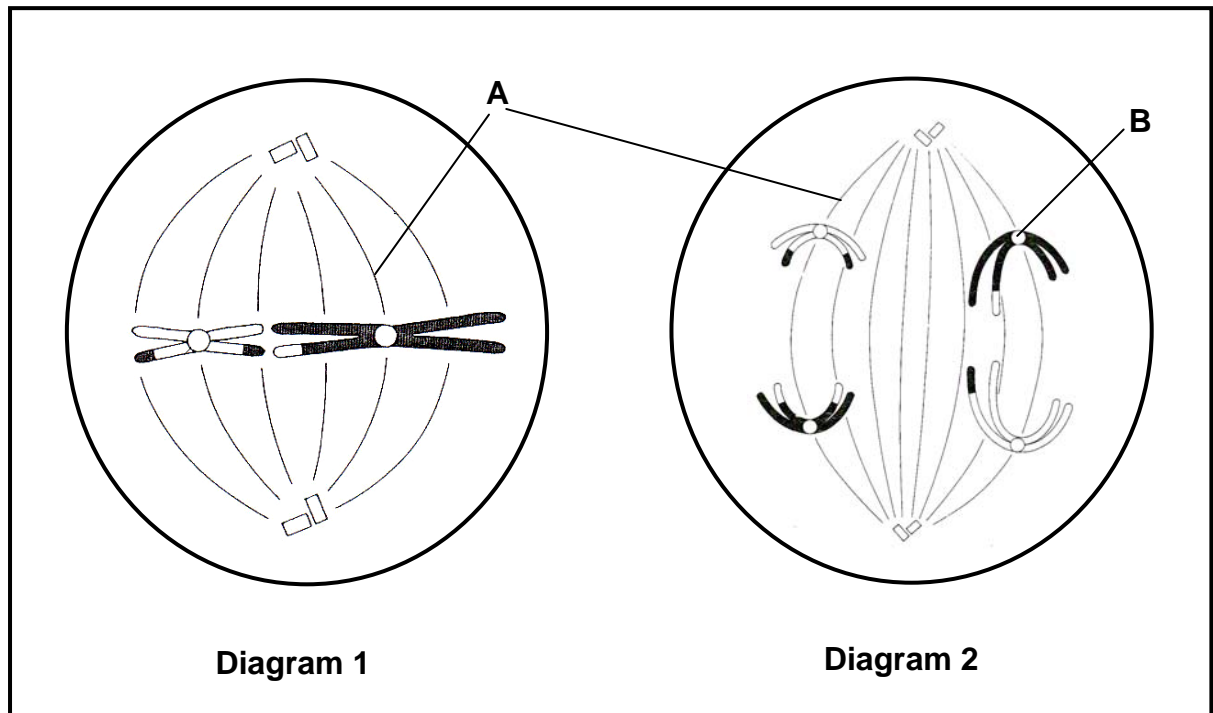
- 1.3 Indicate whether each of the statements in COLUMN I applies to A only, B only, both A and B or none of the items in COLUMN II. Write A only, B only, both A and B, or none next to the question number (1.3.1 – 1.3.6) in the ANSWER BOOK.

| COLUMN I  | COLUMN II                        |
|---|----------------------------------|
| 1.3.1 Carries genetic material  | A genes<br>B chromosomes         |
| 1.3.2 The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell           | A karyotype<br>B phenotype       |
| 1.3.3 An individual that has one dominant gene and one recessive gene for a particular characteristic | A homozygous<br>B heterozygous   |
| 1.3.4 Prevents fertilisation  | A contraception<br>B conception  |
| 1.3.5 The formation of gametes  | A spermatogenesis<br>B oogenesis |
| 1.3.6 The genotype of blood group AB  | A $I^A i$<br>B $I^B i$           |

(6 x 2)

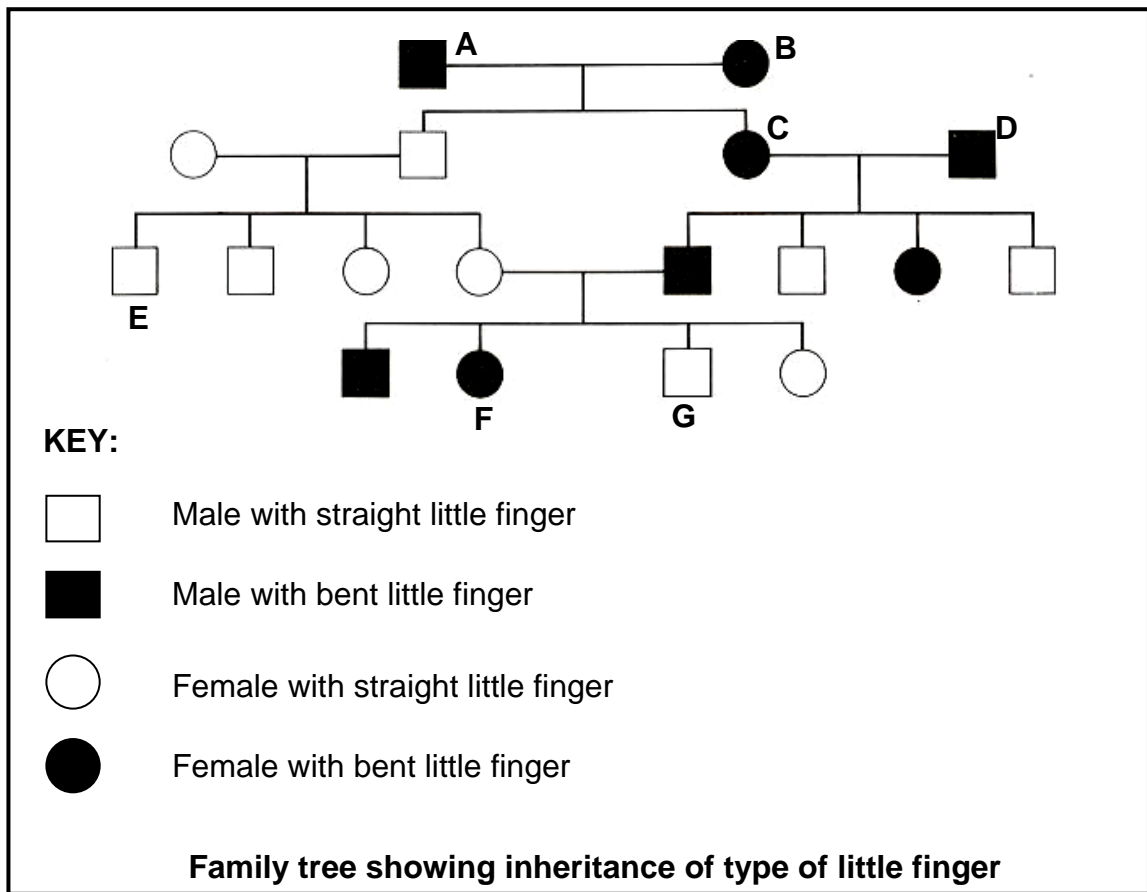
(12)

1.4 The diagrams below represent two different phases in meiosis of two different cells.



- 1.4.1 Give the names of the parts labelled:
- (a) A (1)
  - (b) B (1)
- 1.4.2 Identify the phase represented in:
- (a) Diagram 1 (1)
  - (b) Diagram 2 (1)
- 1.4.3 Name the process during meiosis which is responsible for the appearance of the chromosomes illustrated in Diagram 1. (1)
- 1.4.4 How many chromosomes would be found in each of the resulting cells at the end of the division of the cell shown in Diagram 1? (1)
- 1.4.5 Explain TWO ways in which meiosis is important. (4)

1.5 Study the family tree below which shows inheritance of the type of little finger over four generations of a family.



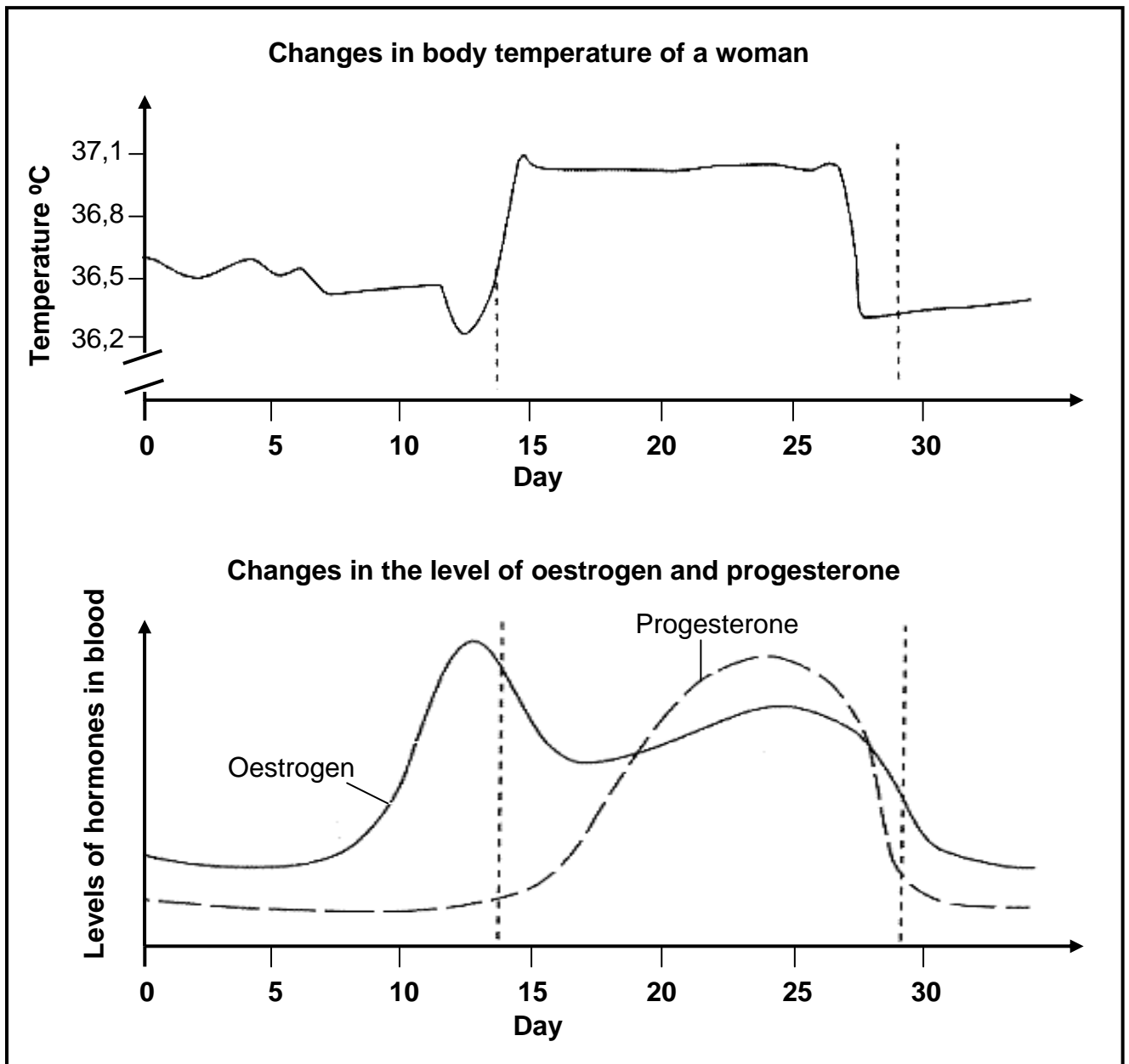
- 1.5.1 How many members of the family have straight little fingers? (1)
- 1.5.2 Is person F homozygous or heterozygous for the type of little finger? (1)
- 1.5.3 Which type of little finger is controlled by a dominant gene? (1)
- 1.5.4 Explain your answer to QUESTION 1.5.3. (3)
- 1.5.5 In the fourth generation of the family, what proportion will be female with a straight little finger? (2)
- 1.5.6 Persons F and G are twins. Were they produced from a single fertilised egg cell? (1)
- 1.5.7 Give TWO reasons based on the phenotype to support your answer to QUESTION 1.5.6. (2)

**TOTAL SECTION A: 50**

**SECTION B**

**QUESTION 2**

2.1 The following two graphs show the changes in temperature in a woman's body and the level of the hormones oestrogen and progesterone during the menstrual cycle. The release of the ovum takes place when there is a very small increase in body temperature.



2.1.1 What was the temperature of the woman on day 15? (2)

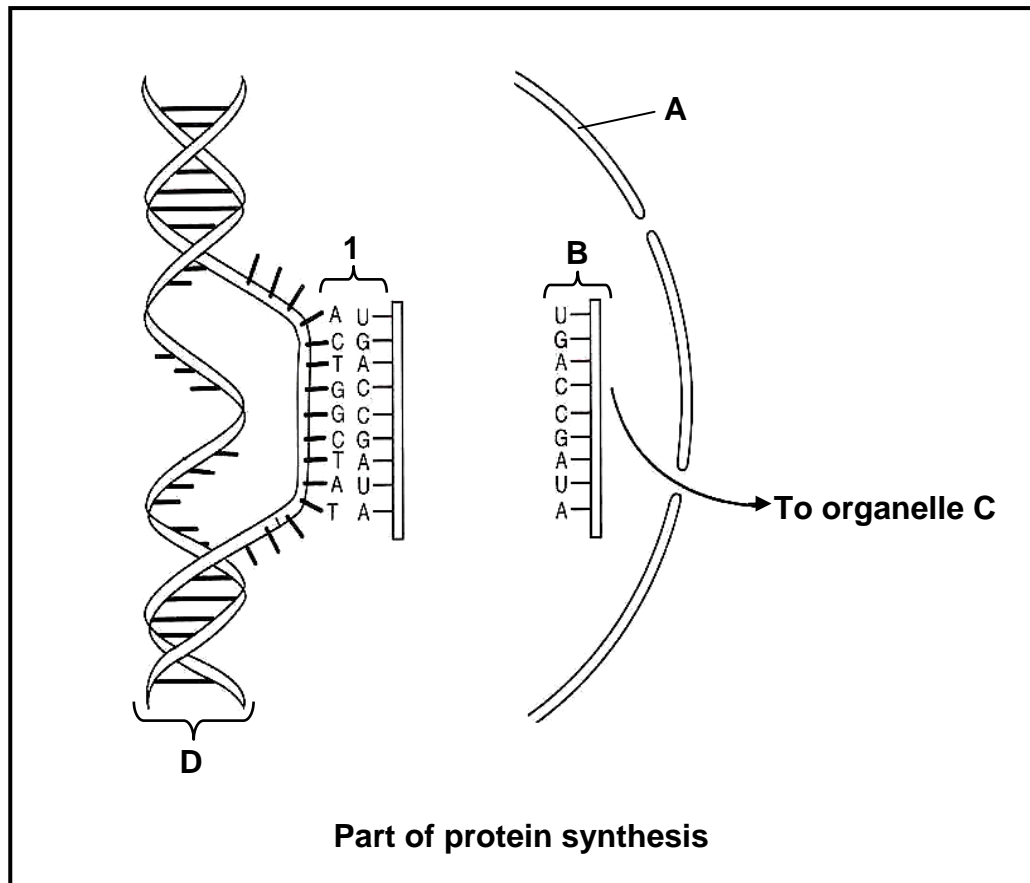
2.1.2 Calculate by how many degrees Celsius her temperature varied in one menstrual cycle. Show ALL workings. (2)



2.1.3 From the graph, name THREE factors that indicate that ovulation occurred. (3)

2.1.4 Explain the importance of the higher level of progesterone from day 15 onwards. (2)

2.2 Study the diagram below which shows part of the process of protein synthesis.



2.2.1 Provide labels for structures A, B and D respectively. (3)

2.2.2 State ONE function of molecule D. (1)

2.2.3 Which part of protein synthesis takes place at 1? (1)

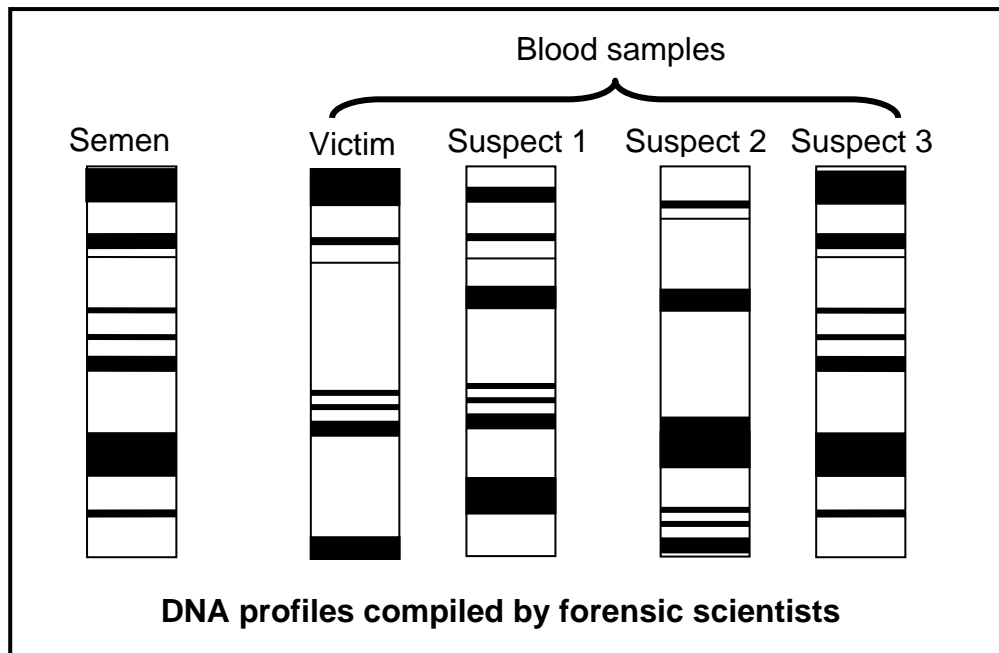
2.2.4 Name the type of proteins that control the process named in QUESTION 2.2.3. (1)

2.2.5 Identify organelle C. (1)

2.2.6 Name and describe the part of protein synthesis that takes place at organelle C. (6)

2.3 Study the diagram below which shows the following DNA profiles/genetic fingerprints:

- Blood of a raped female victim
- Blood of three suspects
- Semen found on the female victim



- 2.3.1 Which suspect was most likely the rapist? (1)
- 2.3.2 Explain your answer to QUESTION 2.3.1. (2)
- 2.3.3 Give ONE reason why this evidence may be considered reliable. (1)
- 2.3.4 Give TWO reasons why this evidence may not be considered reliable. (2)
- 2.3.5 Name TWO benefits of DNA profiling other than for solving crimes. (2)
- [30]**

**QUESTION 3**

- 3.1 In rabbits the dominant allele (B) produces black fur and the recessive allele (b) produces white fur. Study the table below showing the genotypes of four rabbits.

|                 |    |    |    |    |
|-----------------|----|----|----|----|
| <b>Rabbit</b>   | 1  | 2  | 3  | 4  |
| <b>Genotype</b> | BB | Bb | Bb | bb |

- 3.1.1 What are the phenotypes for rabbits 2 and 4 respectively? (2)
- 3.1.2 State the genotypic ratio that is shown in the table above. (1)
- 3.1.3 If rabbits 1 and 4 were mated together and had 12 offspring, how many of these would you expect to be black? (1)
- 3.1.4 Rabbit 2 was allowed to breed with rabbit 3.  
  
Use a genetic cross to show the possible phenotypes and genotypes of the F<sub>1</sub> generation for fur colour. (6)

- 3.2 Study the table below which shows the relationship between the age of a mother and the risk of having a Down's syndrome baby.

| <b>Age of mother (years)</b> | <b>Risk of Down's syndrome baby (per 10 000 births)</b> |
|------------------------------|---|
| 25                           | 8   |
| 35                           | 25  |
| 45                           | 200   |

- 3.2.1 State the relationship between the mother's age and the chance of having a baby with Down's syndrome. (2)
- 3.2.2 By how many times does the risk of having a baby with Down's syndrome increase between 35 and 45 years of age? (1)
- 3.2.3 How many chromosomes are present in a cell of the body of a baby with Down's syndrome? (1)
- 3.2.4 Explain why a person with Down's syndrome has an abnormal number of chromosomes. (4)

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

**Vaccine-producing bananas**

Vaccinations protect people all over the world from diseases. Scientists are working on producing a genetically modified banana that will act as a vaccine against hepatitis B, a liver disease that affects more than 2 billion people worldwide.

In future, many vaccines and other medicines may be given to people and other animals in easy-to-eat fruit and vegetables.

3.3.1 State THREE possible advantages of using bananas as a vaccine against diseases. (3)

3.3.2 Give THREE reasons why people might be against the use of genetically modified bananas. (3)

3.4 An investigation was conducted by grade 12 learners on fruit flies to determine the genotypic and phenotypic ratios of the  $F_2$  generation. They placed 12 homozygous red-eyed females in a flask with 12 homozygous white-eyed males. The flask contained a ripe fruit and the opening of the flask was covered with cotton wool. After three weeks the  $F_1$  offspring were crossed and the results ( $F_2$ ) are shown in the table below.

|            | Number of offspring ( $F_2$ ) |
|------------|-------------------------------|
| Red-eyed   | 27                            |
| White-eyed | 9                             |

3.4.1 Give TWO reasons why cotton wool was used. (2)

3.4.2 State ONE way in which the reliability of the results could be improved. (1)

3.4.3 Using the symbols R and r to represent the alleles for eye colour, state all the possible genotypes of the:

(a) Red-eyed fruit fly of the  $F_2$  offspring

(b) White-eyed fruit fly of the  $F_2$  offspring

(3)  
[30]

**TOTAL SECTION B: 60**

**SECTION C****QUESTION 4**

- 4.1 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 sperms in a petri dish which contains a fluid with salts and nutrients and is kept at around 37 °C.
- The ova are then observed under a microscope to see if cell division takes place. If cell division (mitosis) does 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%.

- 4.1.1 Explain why a fertility expert would want many ova to develop in a woman's ovaries. (2)
- 4.1.2 Why are the petri dish and nutrients kept at 37 °C? (1)
- 4.1.3 Explain why the embryos are put into the uterus after three days, and not before. (1)
- 4.1.4 Explain TWO reasons why people might:
- (a) Support the use of in vitro fertilisation (4)
- (b) Be against the use of in vitro fertilisation (4)

- 4.2 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     |

- 4.2.1 Draw TWO sets of bar graphs on the same system of axes to compare male and female foetal length over time. (11)
- 4.2.2 Draw TWO conclusions from the results shown in the graphs. (2)
- 4.3 Name any FOUR methods of contraception used by men. For EACH method, explain how effective it is and explain its role in the prevention of sexually transmitted diseases. (12)

Synthesis (3)

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

**TOTAL SECTION C: 40**

**GRAND TOTAL: 150**