

SENIOR SECONDARY IMPROVEMENT PROGRAMME 2013



GRADE 12

LIFE SCIENCES

TEACHER NOTES

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TEACHER NOTES

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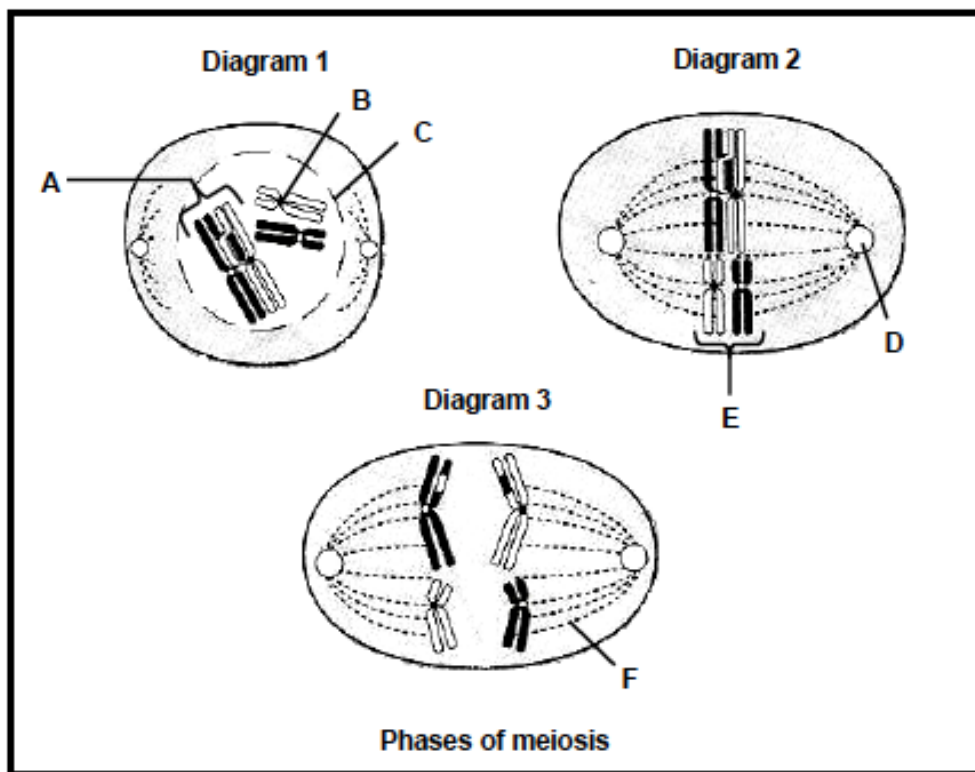
SESSION 2 SELF STUDY: TOPIC 1: CONSOLIDATION EXERCISES- MEIOSIS AND DNA

Teacher Note: The consolidation exercises have been extracted from past examination papers to assist you to assess the learners. The exercises will assist the learners with exam techniques and time allocation. Please ensure that the learners adhere to the time allocations. We suggest that you read through the question with the learners. Point out the important words and tell the learners to underline these words. Point out that they must take careful note of the marks per question. Then start the question and the time. After the allocated period, stop the learners and begin to go through the next question and follow the same process. If they have not completed a question, they must complete it when you work through the memo with them. Please write the answers on the board so that they are able to correct their answers accurately. The learner will lose the marks for the questions that they have not completed. Perhaps set up a competition type situation where the learners put up their hands as soon as they have finished their question. Check the number of learners who are able to complete the question in the allocated time. Encourage learners to work fast but correctly.

SECTION A: TYPICAL EXAM QUESTIONS

QUESTION 1: 13 minutes (Taken from DoE Additional Exemplar 2008 Paper 1)

The diagrams below represent phases of meiosis.



Teacher Note: Remind the learners to write in all the labels first before doing the questions.

- 1.1 Name the process taking place at A. (1)
 - 1.2 Identify structures B, C, D and E. (4)
 - 1.3 State **ONE** function of F. (2)
 - 1.4 What **phase** of meiosis is represented in Diagram 2? (2)
 - 1.5 Give a reason for your answer to QUESTION 2.1.4. (2)
 - 1.6 How many chromosomes are shown in Diagram 3? (1)
 - 1.7 Name **ONE organ** in the human female body where the process of **meiosis** will occur. (1)
- [13]

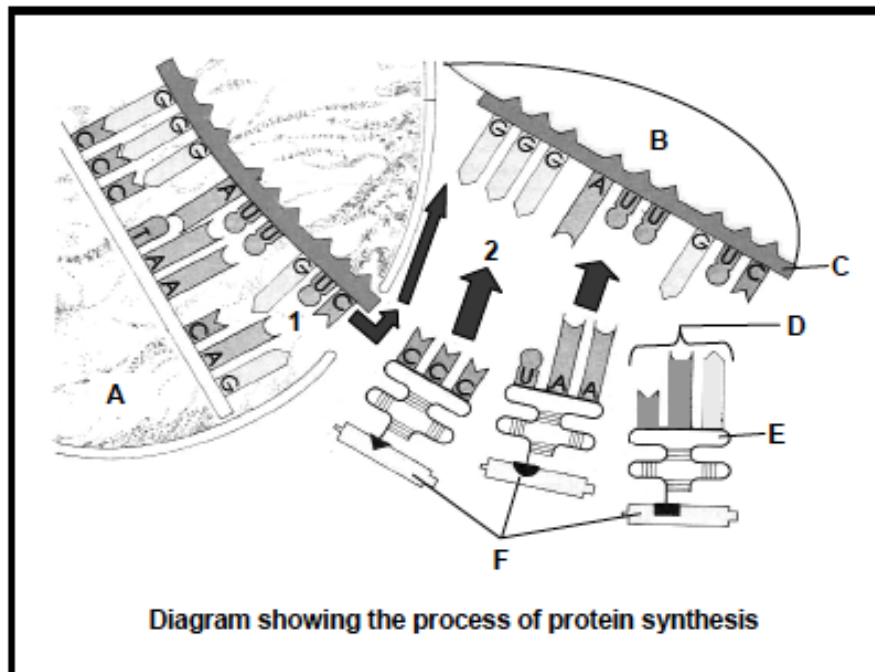
QUESTION 2: 7 minutes (Taken from DoE Additional Exemplar 2008 Paper 1)

Tabulate THREE differences between DNA and RNA.

(Remember to give your table a suitable heading/caption. Compare the same characteristics for each of the columns. [7])

QUESTION 3: 10 minutes (Taken from DoE Additional Exemplar 2008 Paper 1)

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



- 3.1 Identify organelles A and B respectively. (2)
 - 3.2 Label structures C, E and F respectively. (3)
 - 3.3 Which stage of protein synthesis is represented at:
 - (a) 1? (1)
 - (b) 2? (1)
 - 3.4 Write down the anticodon that reads from left to right at D. (3)
- [10]

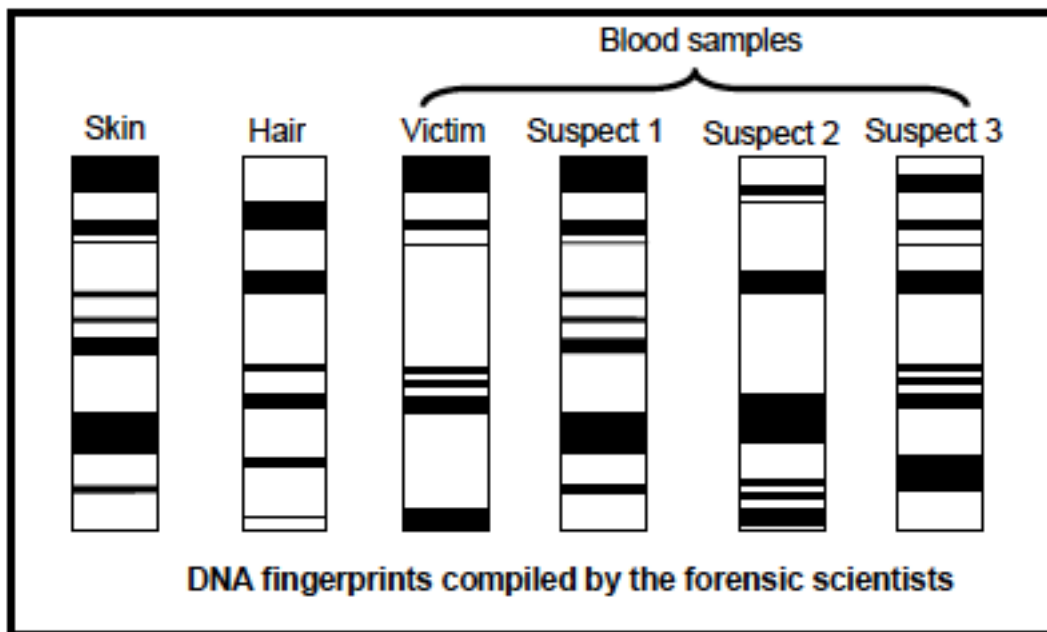
QUESTION 4:**10 minutes***(Taken from DoE Exemplar 2008 Paper 1)*

A woman was found stabbed to death in a hotel. The police found a few strands of hair in her one hand. There was also skin tissue under her long nails.

Forensic scientists took blood samples from three suspects to compile DNA fingerprints. DNA fingerprints were also compiled from the victim's blood and the hair and skin tissue found in the victim's hands.

The following diagram shows the DNA fingerprints of the hair sample, the skin tissue sample and blood from the victim and the three suspects.

(Remember to use a ruler horizontally so that you do not make a mistake when comparing the VNTR markers.)



- 4.1 Did the DNA from the hair and skin tissue come from the same person? (1)
 - 4.2 What conclusion can you make from QUESTION 4.1 about the possible number of people involved in the murder? (2)
 - 4.3 Which of the three suspects might have been involved in the murder? (1)
 - 4.4 Give a reason for your answer to QUESTION 4.3. (1)
 - 4.5 Do you think that the DNA evidence on its own is enough to convict a suspect? (1)
 - 4.6 Give a reason for your answer to QUESTION 4.5. (2)
 - 4.7 Explain whether the collection of DNA from every citizen in South Africa to create a DNA fingerprint database is a good idea or not. (2)
- [10]

SECTION B: SOLUTIONS TO SECTION A: TOPIC 1

QUESTION 1

- 1.1 Crossing over (1)
- 1.2 B – Centromere (1)
 C – Nuclear membrane (1)
 D – Centrosome/centriole (1)
 E – Homologous chromosomes (1)
- 1.3 Part F/Spindle threads contract✓ to move chromosomes✓ towards opposite poles. Allow for the attachment✓ of chromosomes✓ (Any 1 x 2) (2)
(Mark first ONE only)
- 1.4 Metaphase1 ✓✓ (2)
- 1.5 Chromosomes arranged along the equator✓ in homologous pairs✓ (2)
(Mark first one only)
- 1.6 4 (1)
- 1.7 Ovary (1)
(Mark first ONE only)

[13]**QUESTION 2**

DNA	RNA
1. Double helix/double stranded	1. Single strand
2. Sugar is deoxyribose	2. Sugar is ribose
3. Thymine is a base	3. Uracil is a base
4. Equal number of A = T and G = C	4. Bases in any number and ratio
5. Occurs in the nucleus only	5. Occurs in the nucleus and cytoplasm

Any 3 x 2 = 6+1 for table *(Mark first THREE differences only)***[7]****QUESTION 3**

- 3.1 A –Nucleus✓
 B –Ribosome✓ (2)
- 3.2 C –mRNA✓
 E –tRNA✓
 F - Amino acids✓ (3)
- 3.3 (a) Transcription (1)
 (b) Translation (1)
- 3.4 C✓A✓G✓ (3)

[10]

QUESTION 4

- 4.1 No (1)
- 4.2 There was more than 1 person involved in the murder✓✓/possibly 2✓✓ (2)
- 4.3 Suspect 1 (1)
- 4.4 The DNA fingerprint of the skin found under the victim's fingernail matches the DNA fingerprint of suspect 1 (1)
- 4.5 No (1)
- 4.6 - The hair/skin tissue could have been planted✓at the crime scene✓
- OR**
- The DNA from the skin tissue could have been under the victim's finger nails✓
- before the murder✓
- OR**
- The suspect may have an identical twin✓who has the same DNA fingerprint✓
- OR**
- The samples taken may be mixed✓with others✓in the laboratory (2)
- 4.7 Tracing criminals✓ would be made easier✓
- OR**
- It infringes on the rights of people✓ who might not want their fingerprint done✓
- OR**
- It would cost the country too much money✓which could be used for basic needs like food/housing✓ (2)

[10]

SESSION 2 SELF STUDY: TOPIC 2: CONSOLIDATION EXERCISE - MEIOSIS AND HUMAN FINGERPRINTING

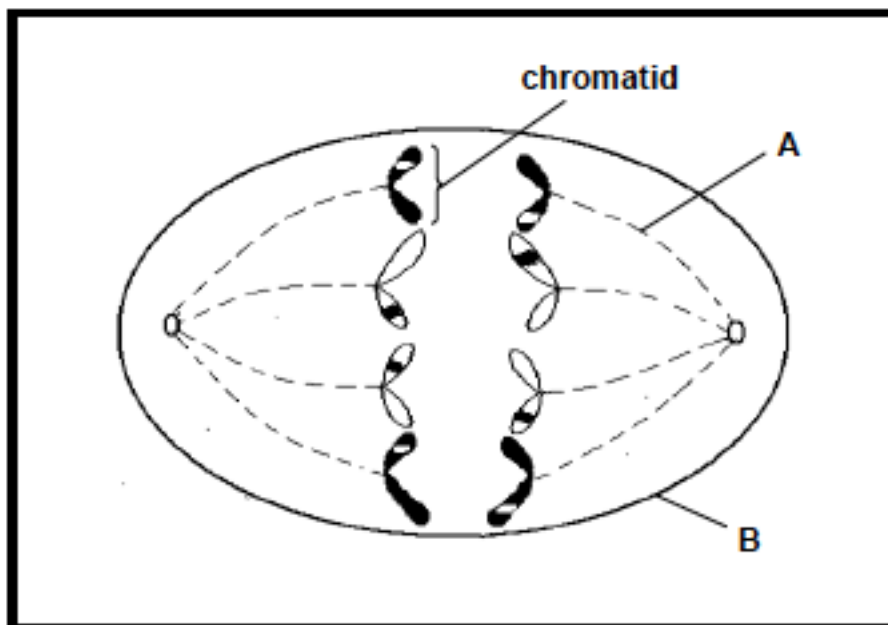
Teacher Note: The consolidation exercises have been extracted from past examination papers to assist you to assess the learners. The exercises will assist the learners with exam techniques and time allocation. Please ensure that the learners adhere to the time allocations. We suggest that you read through the question with the learners. Point out the important words and tell the learners to underline these words. Point out that they must take careful note of the marks per question. Then start the question and the time. After the allocated period, stop the learners and begin to go through the next question and follow the same process. If they have not completed a question, they must complete it when you work through the memo with them. Please write the answers on the board so that they are able to correct their answers accurately. The learners will lose the marks for the questions that they have not completed. Perhaps set up a competition type situation where the learners put up their hands as soon as they have finished their question. Check the number of learners that are able to complete the question in the allocated time. Encourage learners to work fast but correctly.

SECTION A: TYPICAL EXAM QUESTIONS

EXERCISES: - 60 minutes including going through the memo

QUESTION 1: 13 minutes

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

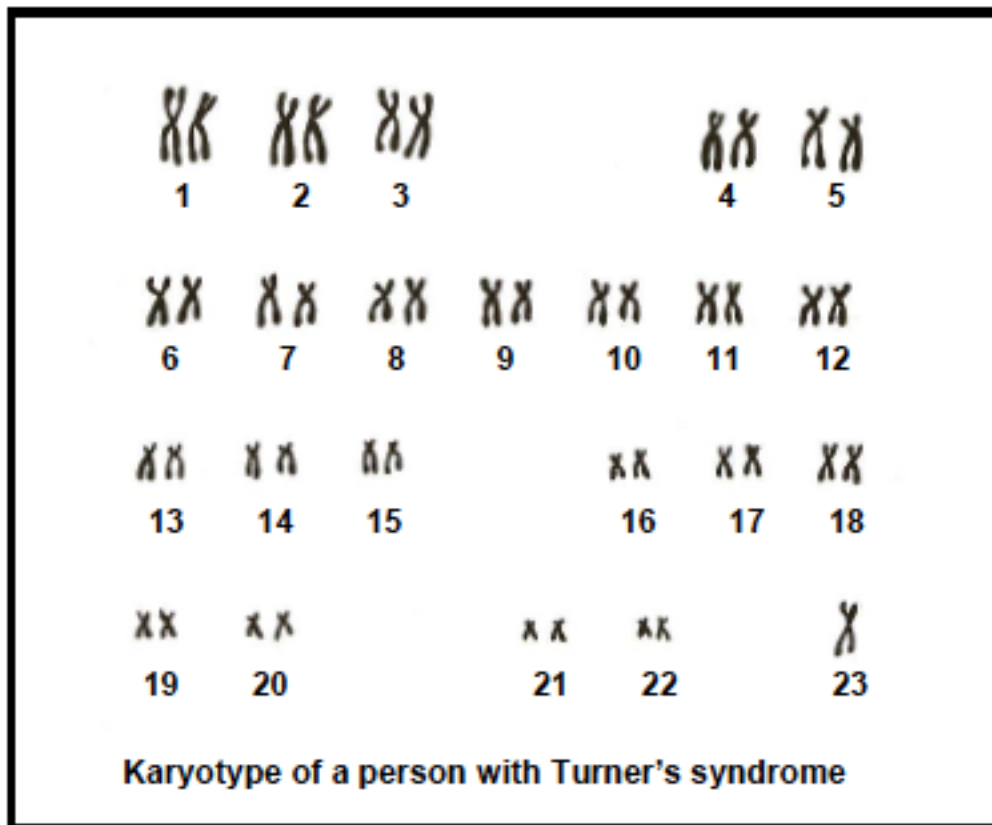


Remember to complete the labels before you move on to the questions.

- 1.1 State which **phase of meiosis** is represented in the diagram above. (1)
 - 1.2 Give a reason for your answer to QUESTION 1.1. (2)
 - 1.3 Identify parts A and B. (2)
 - 1.4 How **many chromosomes** ...
 - (a) were present in the parent cell **before** it underwent **meiosis**? (1)
 - (b) will be present in each cell at the **end** of the **meiotic division**? (1)
 - 1.5 State ONE place in the body of a human **female** where meiosis would take place. (1)
 - 1.6 Could the cell represented in the diagram be that of a **human**? (1)
 - 1.7 Explain your answer to QUESTION 1.6. (2)
 - 1.8 Give **TWO reasons** why meiosis is **biologically important**. (2)
- [13]

QUESTION 2: 4 minutes

Study the karyotype below of a person suffering from Turner's syndrome. Females with Turner's syndrome do not develop mature sex organs.

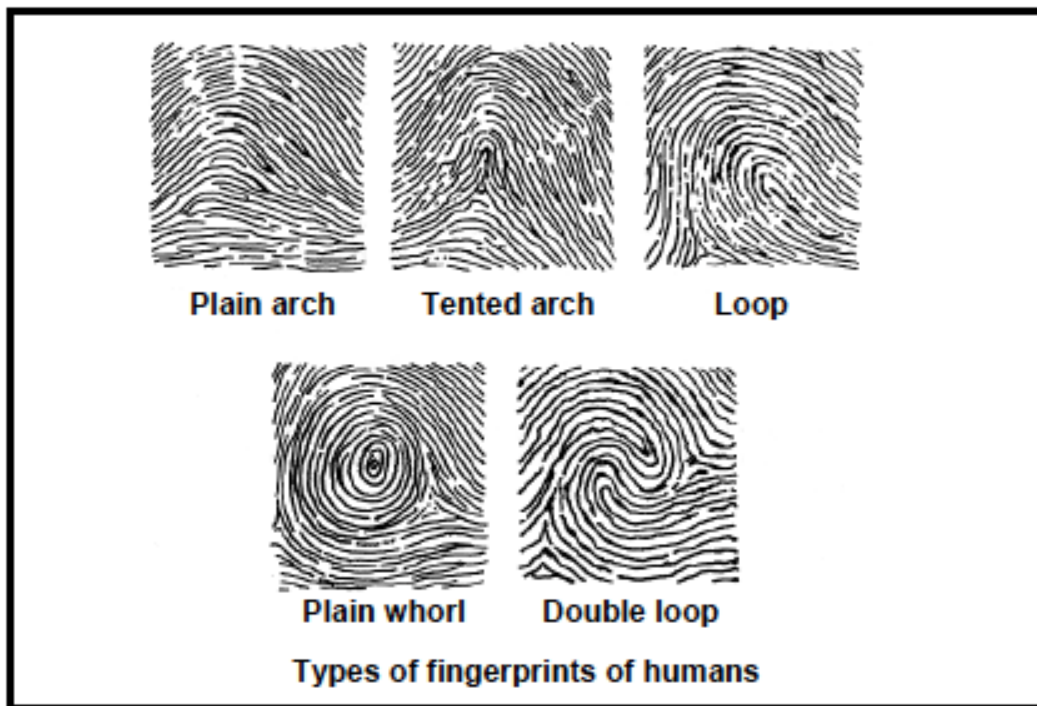


Remember: there are 44 autosomes and only one X chromosome. Chromosome pair 23 is the sex chromosomes: in males XY and in females XX normally.

- 2.1 State the **differences** between the karyotype for a **normal female** and a female with **Turner's syndrome**. (2)
 - 2.2 Explain **ONE effect** of the disorder in a female. (2)
- [4]

QUESTION 3: 13 minutes

Humans show differences in characteristics such as fingerprints. Humans have **five main types** of fingerprints as shown in the diagram below:



A fingerprint is a useful way of **identifying people** and **classifying** them into groups. A fingerprint is taken by rolling the right index finger onto an ink pad and then onto a piece of paper.

During a discussion of this topic, a group of learners asked the following question: "Which one of the five main types of fingerprints is **most common** amongst the learners of this school?"

- 3.1 State any **FOUR steps** in the planning process that must be considered when **planning an investigation** to answer the question above. (4)
- 3.2 The learners carried out an investigation and the results are shown in the table below.

Main types of fingerprints	Number of learners
Plain arch	123
Tented arch	112
Loop	124
Plain whorl	150
Double loop	50

- (a) Give a **caption** for the table. (2)
(Remember that a caption is a heading where the words 'types of fingerprints' and 'learners' would have to be included since these are the headings of the two columns.)

- (b) Learners came to the following conclusion:
Most learners have the plain arch-type fingerprint.
 Is this a valid conclusion? (1)

(Remember that validity is based on the numbers, the accuracy and similar conditions like ages, males/females as applicable, etc)

- (c) Give a reason for your answer to QUESTION (b). (2)

3.3 State the following:

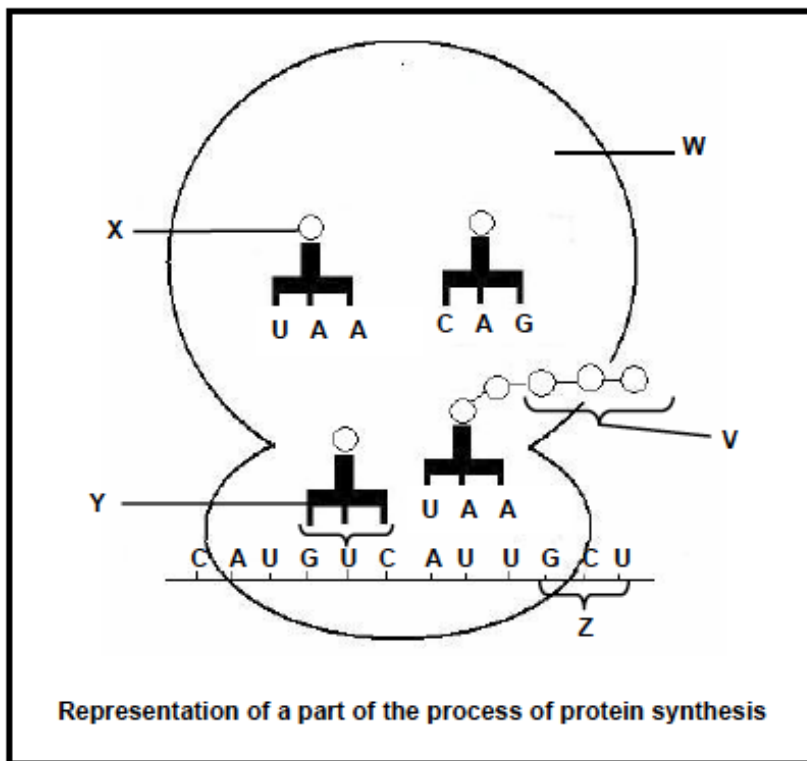
- (a) **TWO advantages** of having a fingerprint database of every citizen and visitor in South Africa (2)

- (b) **TWO disadvantages** of having a fingerprint database of every citizen and visitor in South Africa (2)

[13]

QUESTION 4: 9 minutes

The diagram below represents a part of the process of protein synthesis.



- 4.1 Name the part/stage of protein synthesis that is illustrated in the diagram above. (1)
- 4.2 Name the organelle labelled W. (1)

- 4.3 The table below shows the base triplets of mRNA that correspond to the different amino acids.

mRNA	AMINO ACID
CAU	histidine
AUU	isoleucine
GUC	valine
CUU	leucine
GCU	alanine
CCU	proline
CGA	arginine

With reference to the diagram in QUESTION 4 above:

- Name the amino acid labelled X. (1)
 - State the base sequence of the molecule labelled Y. (1)
 - What **collective name** is given to the triplet of mRNA bases that correspond to each amino acid? (1)
 - How would the **composition** of the protein molecule change if the base sequence at Z was CGA instead of GCU? (2)
- 4.4 Use the information in the table to write the **DNA base sequence** that would correspond with the amino acid **hitidine**. (2)
- [9]

SECTION B: SOLUTIONS TO SECTION A: TOPIC 2

QUESTION 1

- Anaphase II✓ (1)
- (Sister) chromatids✓/(daughter) chromosomes are moved✓/pulled towards the poles (2)
- Spindle✓fibre
 - Cell membrane✓ (2)
- (1)
 - (1)
- Ovary✓/germinal epithelium/follicle (1)
- No✓ (1)
- Humans would have 23✓chromosomes/46 chromatids in this phase. This diagram shows only 4 chromosomes✓/8 chromatids /incorrect number of chromosomes (2)

- 1.8 - Reduction/halving of chromosome number✓/ allows for creation of gametophyte/ keep chromosome number constant from generation to generation/prevents doubling of chromosome number at fertilisation
 - Contributes to genetic variation✓
 - Leads to the formation of gametes✓ (Any) **(Mark first TWO only)** (2)
[13]

QUESTION 2

- 2.1 Normal female: Chromosome pair 23 = XX✓/46 chromosomes
 Female with Turner's syndrome: Only one X✓ chromosome/ 45chromosomes (2)
- 2.2 She will not be able to have children✓ since her sex organs will not develop✓
OR
 No menstrual cycle✓ because there are underdeveloped gonads✓/ and, therefore, no hormones
OR
 No sex hormones✓ and therefore secondary sexual characteristics will not appear✓ (2)
(Mark first ONE only) [4]

QUESTION 3

- 3.1 Hypothesis formulation Formulate hypothesis✓ on what the most common type of fingerprint might be
 Sample selection Identify dependent and independent variables✓
 Determine the sample size✓ of learners to be used
 Method of data collection Learn how to identify the different fingerprint types correctly✓
 Organise an ink-pad and paper to take an imprint✓ of the fingerprint
 Arrange a time and place✓ to take fingerprints
 Data representation Design a table✓ to record the number that have each fingerprint type
 (Any) **(Mark first FOUR only)** (4)

NOTE: Answers must be contextualised to the specific investigation on fingerprint types.

- 3.2 (a) Number of learners✓ with different fingerprint types✓ (2)
 b) No✓ (1)
 (c) Results indicate✓ that most learners✓ have the plain whorl type✓ of fingerprinting (Any 2)
OR
 Results indicate✓ that learners with a plain arch type✓ do not make up the largest number✓ (Any 2)
OR
 Results ✓are not in line with the conclusion✓ (2)

3.3. (a)

Advantages

Can be used to identify

criminals✓

lost children✓

deceased bodies✓

Immigration control✓ can be more strict (Any)

(Mark first TWO only)

(2)

(b)

Disadvantages

Falsely incriminated✓/ (people can be framed)

Infringing on the rights of people✓/invasion of privacy

It is costly✓

Incorrect capture of data✓/human error

Not all persons✓ can be fingerprinted e.g. amputees

(Mark first TWO only)

(2)

[13]**QUESTION 4**

4.1 Translation (1)

4.2 Ribosome (1)

4.3 (a) Isoleucine (1)

(b) CAG✓/cytosine, adenine, guanine✓ (1)

(c) Codon✓ (1)

(d) Have arginine✓ instead of alanine✓/have different✓ amino acids✓ (any 2) (2)

4.4 GTA✓✓ (2)

[9]

TOPIC 1: MENDEL'S 1ST LAW, SEX AND BLOOD GROUP DETERMINATION

Teacher Note: Mendel's Laws are very important for the learners to understand the basic concepts of genetics. Learners must understand the concepts of dominance, and how this plays a role in monohybrid crosses. Be aware that the learners tend to confuse the word 'crossing' with 'crossing over' in Meiosis. Ensure that they understand the difference. Questions on blood group inheritance and sex determination are often asked in examination papers. The more examples of genetic crosses the learners do, the better they will be at doing them.

LESSON OVERVIEW

- | | | |
|----|----------------------------|------------|
| 1. | Introduce section of work: | 5 minutes |
| 2. | Typical exam questions: | 36 minutes |
| 3. | Solutions and Hints: | 19 minutes |

SECTION A: TYPICAL EXAM QUESTIONS**QUESTION 1: 6 minutes** *(Taken and adapted from Study & Master Biology Grade 11)*

Blood typing can be used to identify a parent in that the blood type can prove that a person is not the parent of a child rather than determine without question who the parent is. A, B, AB and O blood groups are the result of three alleles. Allele A and B are co-dominant and O is recessive to both A and B. Should the discrepancy continue, tissue typing and DNA fingerprinting will be used. Read through the following information and answer the questions below:

In a maternity ward of a hospital, two newly born babies were mixed up. One baby is blood type O and the other is type A. Both mothers believe the baby with blood type O is their baby. Can you sort it out?

On testing the parents' blood it was found that:

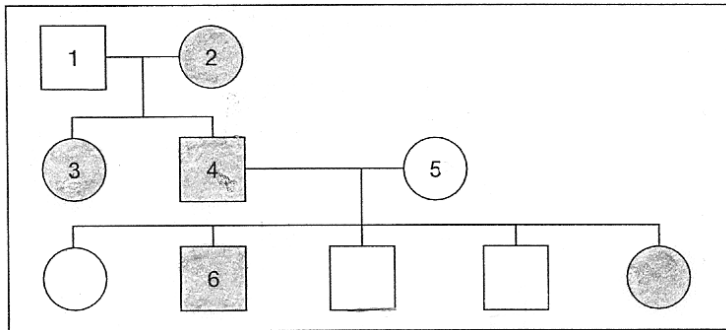
1. Mr. Xhosa is blood group AB and his wife is blood group B
2. Mr. Mbundwini is type A.

Who owns baby 'O' and who owns baby 'A'? Explain / show your reasoning. [6]

HINT: Remember that in blood groups there are three alleles A, B and O. A and B are co-dominant over O which is recessive. There must be two of the same alleles if a recessive trait is present in the individual.

QUESTION 2: 11 minutes*(Taken and adapted from Study&Master Biology Grade 11)*

The diagram below shows the inheritance of eye colour in humans. The squares represent men and the circles, women. The individuals represented in shaded symbols have brown eyes and the unshaded symbols have blue eyes. Brown eye colour (B) is dominant over blue eye colour (b).



- 2.1. Use the letter B and b as indicated and write down the genotypes of the individuals numbered 1 to 5. (5)

HINT: Remember that genotype will be what is in the genes and not what you can see.

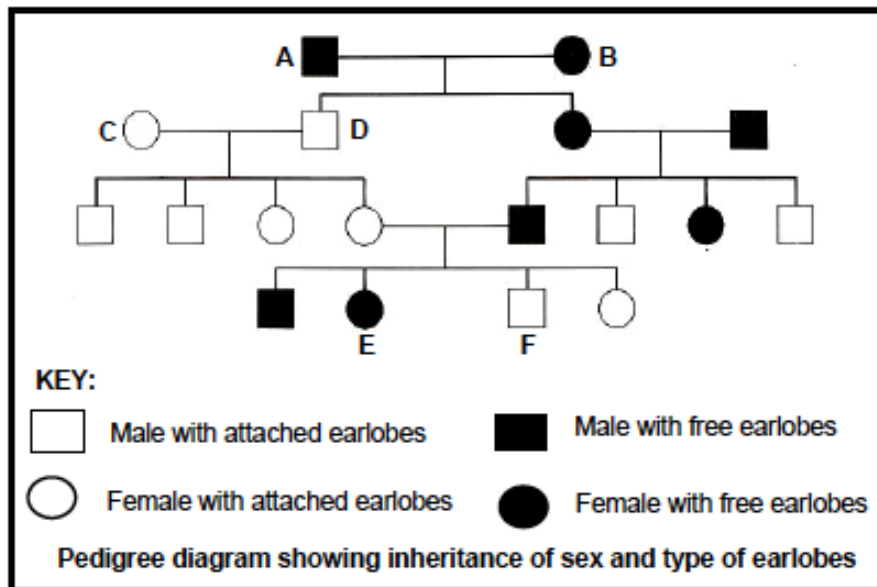
- 2.2. Draw a diagrammatic representation of all the genetic combinations with regard to eye colour, of the descendants when 6 marries a woman with the same genetic composition as 3. Use the letters B and b to show the genotype and phenotype of this F¹ generation. (6)

HINT: Remember to use a Punnett square. Refer to your notes to check that you write all the information required or you will lose unnecessary marks.

[11]

QUESTION 3: 13 minutes*(Taken from DoE Additional Exemplar 2008 Paper 1)*

Study the family tree below which shows the inheritance of sex and type of earlobes over four generations of a family. In humans, free earlobes (F) are dominant over attached earlobes (f).

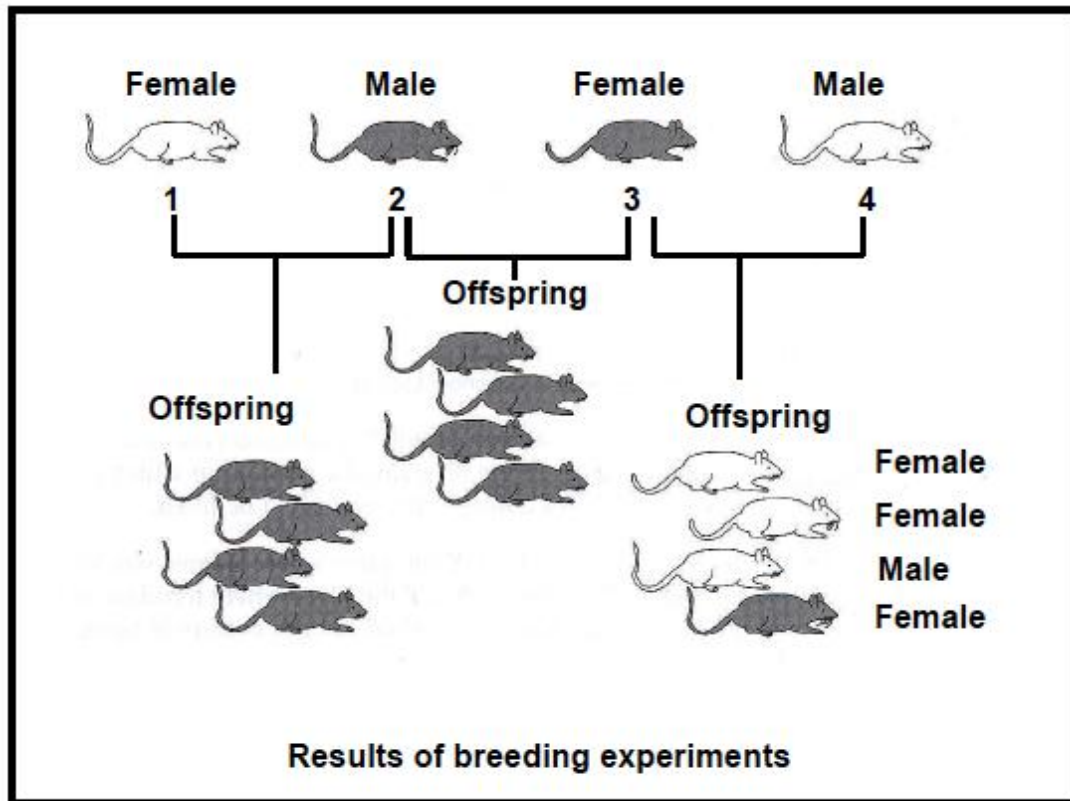


- 3.1. How many members of the family have free earlobes? (1)
- 3.2. What proportion of offspring in the fourth generation are females with attached earlobes? (2)
- 3.3. If the genotype of person A is FF, what will be the genotype of person B? (2)
- 3.4. Give a reason for your answer to QUESTION 3.3. (2)
- 3.5. Persons E and F are twins. Were they produced from a single fertilised egg cell or from two separately fertilised egg cells? (1)
- 3.6. Explain your answer to QUESTION 3.5. (2)
- 3.7. Is it possible for individuals C and D to have a child with free earlobes? (1)
- 3.8. Explain your answer to QUESTION 3.7. (2)

[13]

QUESTION 4: 6 minutes*(Taken from DoE Feb/March 2009 Paper 1)*

Study the diagram below that shows some breeding experiments on rats. A single pair of alleles showing complete dominance controls coat colour (white or grey) in these mice.



- 4.1. State which sex chromosomes would be present in the gametes of parent mouse 2 and mouse 3, respectively. (2)
- 4.2. If mice 3 and 4 had a second set of offspring, what is the percentage chance that the first mouse born would be female? (1)
- 4.3. Which of the parent mice (1, 2, 3 or 4) is likely to be homozygous dominant for coat colour? (1)
- 4.4. State why mouse 3 can only be heterozygous for coat colour. (2)
- [6]

SECTION B: SOLUTIONS AND HINTS TO SECTION A

QUESTION 11.1. Mr. Xhosa - $I^A I^B$ ✓Wife - $I^B I^B$ or $I^B I^O$ ✓ F^1 is $I^A I^B$ or $I^B I^B$ or $I^B I^O$ or $I^A I^O$. ✓✓✓✓

Baby 'A' is the only possible blood group ✓. Baby 'O' is not a possibility

(Remember that in blood groups there are three alleles A, B and O. A and B are co-dominant over O which is recessive. There must be two of the same alleles if a recessive trait is present in the individual.)

1.2. Mr. Mbundwini - $I^A I^A$ or $I^A I^O$ ✓✓

Wife – Not given, but assume she is recessive ✓. Therefore baby 'O' is the possible blood group ✓ as 'O' cannot be the result of Mr. Xhosa and his wife ✓.

(Each tick = ½ mark)**[6]****QUESTION 2**

2.1. BB = brown eyes bb = blue eyes - since both 3 and 4 have brown eyes, 2 will be BB.

1 = bb ✓

2 = BB ✓

3 = Bb ✓

4 = Bb ✓

5 = bb ✓

[5]

2.2. Brown = BB Blue = bb

 P^1 ✓ Bb x Bb - Meiosis ✓

Gametes	B	b	✓
B	BB	Bb	✓
b	Bb	bb	✓
✓			

Fertilisation ✓ F^1 ✓

Genotype: 1:4 Homozygous brown BB, 2:4 Heterozygous brown – Bb ✓ ,
1:4 Homozygous blue – bb ✓

Phenotype: 75% brown ✓ {1 homozygous brown + 2 heterozygous brown}
25% blue ✓ {1 homozygous blue} **(Each tick = ½ mark)**

(6)**[11]**

QUESTION 3

- 3.1 8 (1)
- 3.2 $25 \sqrt{\%}$ (2)
- 3.3 Ff (2)
- 3.4 Individual B would have **one dominant gene** since he/she has free earlobes \checkmark and the other gene **must be recessive** since they were able to produce offspring with attached earlobes/the recessive characteristic \checkmark (2)
- 3.5 Two separate (1)
- 3.6 One is male and the other is female \checkmark
Identical twins are identical in every respect \checkmark /from the same sex (2)
- 3.7 No (1)
- 3.8 Since C and D have attached earlobes \checkmark they have only recessive genes \checkmark and can, therefore, have no dominant gene/gene for free earlobes to pass to their offspring \checkmark . (Any 2) (2)
- [13]**

QUESTION 4

- 4.1 Mouse 2 – XY $\square \checkmark$
Mouse 3 – XX $\square \checkmark$ (2)
- 4.2 50% $\square \checkmark$ (1)
- 4.3 Mouse 2 \checkmark (1)
- 4.4 A cross between mouse 3 and mouse 4 $\square \checkmark$ produced offspring with white \checkmark /recessive coat colour and white colour will only show up if both parents have at least one recessive gene $\square \checkmark$ (Any 2) (2)
- [6]**

SECTION C: HOMEWORK EXERCISES*(Questions taken and adapted from Study & Master Biology Grade 11)***QUESTION 1**

In guinea-pigs, the gene for black coat is dominant to the gene for white. Two heterozygous black guinea-pigs are crossed.

- 1.1. By means of a diagram, show the genotypic results that would be expected in the F^1 generation. (7)
 - 1.2. One of the white F^1 offspring was crossed with its black parent. By means of a diagram show the expected F^1 genotypic results of this new cross. (6)
- [13]

QUESTION 2

In horses black coat colour (B) is dominant over white (b). A white mare mates twice with the same black stallion. She produces a white foal on the first occasion and a black foal on the second occasion. Use the letters B and b as indicated above and write down the genotypes of:

- 2.1. the mare and stallion (2)
 - 2.2. the first and second foal (4)
- [6]

SECTION D: SOLUTIONS TO HOMEWORK**QUESTION 1**

- 1.1. Black = B White = b

$P^1 \checkmark$ **Bb x Bb** - **Meiosis** \checkmark

Gametes	B	b	\checkmark
B	BB	Bb	\checkmark
b	Bb	bb	\checkmark
\checkmark			

Fertilisation \checkmark

$F^1 \checkmark$

Genotype: 1:4 Homozygous black – BB \checkmark , 2:4 Heterozygous black – Bb \checkmark ,
1:4 Homozygous white – bb \checkmark

Phenotype: 75% black {1 homozygous black \checkmark + 2 heterozygous black} \checkmark
25% white {1 homozygous white} \checkmark (**Each tick = ½ mark**) (7)

1.2. Black = B White = b

P¹ ✓ Bb x bb - Meiosis ✓

Gametes	B	b	✓
b	Bb	bb	✓
b	Bb	bb	✓
✓			

Fertilisation ✓

F¹ ✓

Genotype: 2:4 Heterozygous black – Bb ✓, 2:4 Homozygous white – bb ✓

Phenotype: 75% black {1 homozygous black + 2 heterozygous black} ✓
25% white {1 homozygous white} ✓ (Each tick = ½ mark)

(6)

[13]

2.1. Mare is bb ✓ x stallion Bb ✓ (if the stallion were BB, then they would not be able to produce a white foal). (2)

2.2.

Gametes	b	b
B	Bb	Bb
b	bb	bb

(Teacher Note: Learners will have to do their own punnett square / cross to answer 2.2. – no marks are allocated but 2 marks are allocated for each of the answers to the question)

First foal = bb ✓ ✓

Second foal = Bb ✓ ✓

(4)

[6]

TOPIC 2: MENDEL'S 2ND LAW AND GENETIC PROBLEMS

LESSON OVERVIEW

1. Introduction: 5 minutes
2. Typical exam questions: 38 minutes
3. Solutions to the typical exam questions: 17 minutes



Teacher Note: Mendel's Second Law is very difficult for the learners to understand. Ensure that they are comfortable with monohybrid crosses before launching into dihybrid crosses. Explain that dihybrid crosses work on TWO characteristic at a time (di = two). The process is the same as for a monohybrid cross; it is just that the two characteristics are passed to the offspring in **different possible combinations**. If one characteristic has 4 possible outcomes, then two characteristics will be $4 \times 4 = 16$ possible outcomes/combinations. We suggest that you write out the steps to show the crosses of Mendel's pea plants and explain the process carefully to the learners. They must be able to follow each step and understand **WHY** each step is done. Once this has been covered, allow the learners to complete the exercises provided.

SECTION A: TYPICAL EXAM QUESTIONS

QUESTION 1: 25 minutes *(Taken and adapted from Bios Grade 11 – 2002)*

In guinea-pigs, black fur (B) is dominant over albino (b) and course hair (R) is dominant over smooth hair (r).

- 1.1. Supply the genotypes and phenotypes of a cross between homozygous black animal with course hair and an albino animal with smooth hair in the F1 generation. (10)
 - 1.2. Supply the genotypes and phenotypes of the F2 generation if two of the offspring from the F1 generation are crossed. (15)
 - 1.3. Explain Mendel's Law of Independent Assortment (4)
- [29]

QUESTION 2: 13 minutes

A woman with brown eyes and dark hair marries a man with blue eyes and blonde hair. All the children have dark hair, but half have blue eyes and the other half have brown eyes. Provide the genotypes of the parents and the children. Let (E) represent dominant brown eye colour and (e) recessive blue eye colour. Let (B) represent dominant brown hair colour and (b) recessive blonde hair colour. (Show all your workings in punnet squares).

[13]

SECTION B: SOLUTIONS AND HINTS TO SECTION A

QUESTION 1

1.1. Dihybrid cross of homozygous parents:

B = black fur (dominant) b = albino (recessive)

R = course hair (dominant) r = smooth hair (recessive)

The parents are as follows:

‘Parent 1’: **BBRR** – homozygous black AND homozygous course hair and

‘Parent 2’: **bbrr** – homozygous albino AND homozygous smooth hair

Note: Each √
= ½ mark

Step 1: (to establish all the possible combinations)

BBRR x bbrr √√

‘Parent 1’: **BB x RR - Meiosis** √

‘Parent 2’: **bb x rr - Meiosis** √

Gametes √	B	B	√
R	BR	BR	
R	BR	BR	
√			

Gametes √	b	B	√
r	br	Br	
r	br	Br	
√			

Step 2:

(Cross all 16 gene combinations. Remember to choose one letter that will always be written first and write capital letter for the same characteristic in front of the lower case letter)

P₁ √

Gametes √	BR	BR	BR	BR	√
br	BbRr	BbRr	BbRr	BbRr	
br	BbRr	BbRr	BbRr	BbRr	
br	BbRr	BbRr	BbRr	BbRr	
br	BbRr	BbRr	BbRr	BbRr	
√					

Fertilisation √

F₁ √

Genotype: 16:16 √ Heterozygous BbRr √ **Phenotype:** 100% √ black with course hair √
(10)

1.2. F_2 generation: **BbRr x BbRr** ✓✓

Bb x Rr - Meiosis ✓					Bb x Rr - Meiosis ✓			
Gametes ✓	B	b		✓	Gametes ✓	B	b	✓
R	BR	bR			R	BR	bR	
r	Br	br			r	Br	br	
✓					✓			

P₂ ✓

Gametes ✓	BR	Br	bR	br	✓ ✓
BR	BBRR	BBRr	BbRR	BbRr	
Br	BBRr	BBrr	BbRr	Bbrr	
bR	BbRR	BbRr	bbRR	bbRr	
br	BbRr	Bbrr	bbRr	bbrr	
✓✓					

Fertilisation ✓

F₂ ✓

Genotype: 1:16 BBRR ✓; 2:16 BBRr ✓; 1:16 BBrr ✓; 2:16 BbRR ✓; 4:16 BbRr ✓; 2:16 Bbrr ✓; 1:16 bbRR ✓; 2:16 bbRr ✓ and 1:16 bbrr ✓

Phenotype: 9 black with course hair ✓; 3 black with smooth hair ✓; 3 albino with course hair ✓; 1 albino with smooth hair ✓ (15)

1.3. Mendel's Law of independent assortment states that different ✓ pairs of genes **segregate independently** ✓ of the members of other pairs ✓, when two or more characteristics ✓ (traits) are involved in a dihybrid cross.

(4)

[29]

QUESTION 2

B = brown hair colour (dominant) b = blonde hair colour (recessive)
 E = brown eye colour (dominant) e = blue eye colour (recessive)

Female parent: BB Ee – homozygous brown hair AND heterozygous brown eyes

Male parent: bb ee – homozygous blonde hair AND homozygous blue eyes

Step 1:

BB Ee x bb ee ✓✓

**Note: Each ✓
= ½ mark**

Mother: BB x Ee - Meiosis ✓

Father: bb x ee - Meiosis ✓

Gametes ✓	B	B	✓
E	BE	BE	
e	Be	Be	
✓			

Gametes ✓	b	b	✓
e	be	be	
e	be	be	
✓			

Step 2:

P₁ ✓

Gametes ✓	BE	BE	Be	Be	✓✓
be	BbEe	BbEe	Bbee	Bbee	
be	BbEe	BbEe	Bbee	Bbee	
be	BbEe	BbEe	Bbee	Bbee	
be	BbEe	BbEe	Bbee	Bbee	
✓✓					

Fertilisation ✓

F₁ ✓ **Genotype:** 8:16 ✓ BbEe ✓ ; 8:16 ✓ Bbee ✓

Phenotype: 50% ✓ brown hair and brown eyes ✓
 50% ✓ brown hair and blue eyes ✓

[13]

SECTION C: HOMEWORK

QUESTION 1: 30 minutes *(Taken and adapted from Bios Grade 11 – 2002)*

In a particular pigeon type, it was found that red eye colour (R) is dominant over black eye colour (r), while grey tail feathers (G) is dominant over white tail feathers (g).

Use punnett squares to show the genotype and phenotype of the offspring that would result from the following crosses:

- 1.1. GgRr x GgRr (15)
 1.2. GgRr x GgRR (14)
 [29]

SECTION D: SOLUTIONS TO HOMEWORK: MENDEL'S 2ND LAW AND GENETIC PROBLEMS

QUESTION 1

- 1.1. G = grey tail feathers (dominant) g = white tail feathers (recessive)
 R = red eye colour (dominant) r = black eye colour (recessive)

The parents are as follows:

'PARENT 1': GgRr – heterozygous grey tail feathers AND heterozygous red eye colour and

'PARENT 2': GgRr – heterozygous grey tail feathers AND heterozygous red eye colour

Step 1:

GgRr x GgRr ✓

'Parent 1': Gg x Rr - Meiosis ✓

Gametes	G	g	✓
R	GR	gR	
r	Gr	gr	
✓			

'Parent 2': Gg x Rr - Meiosis ✓

Gametes	G	g	✓
R	GR	gR	
r	Gr	gr	
✓			

Step 2:**P₁** ✓

Gametes ✓	GR	Gr	gR	gr	✓✓
GR	GGRR	GGRr	GgRR	GgRr	
Gr	GGRr	GGrr	GgRr	Ggrr	
gR	GgRR	GgRr	ggRR	ggRr	
Gr	GgRr	Ggrr	ggRr	ggrr	
✓✓					

Fertilisation ✓**F₁** ✓

Genotype: 1:16 GGRR ✓; 2:16 GGRr ✓; 1:16 GGrr ✓; 2:16 GgRR ✓; 4:16 GgRr ✓; 2:16 Ggrr ✓; 1:16 ggRR ✓; 2:16 ggRr ✓; 1:16 ggrr ✓

Phenotype: 9 with grey tail feathers and red eyes ✓; 3 with grey tail feathers and black eyes ✓; 3 with white tail feathers and red eyes ✓; 1 white tail feathers and black eyes ✓ (15)

1.2. G = grey tail feathers (dominant)

g = white tail feathers (recessive)

R = red eye colour (dominant)

r = black eye colour (recessive)

The parents are as follows:

'Parent 1': GgRr – heterozygous grey tail feathers AND heterozygous red eye colour and**'Parent 2': GgRR** – heterozygous grey tail feathers AND homozygous red eye colour**Step 1:**

GgRr x GgRR ✓✓

'Parent 1': Gg x Rr - Meiosis ✓**'Parent 2':** Gg x RR - Meiosis ✓

Gametes	G	g	✓
R	GR	gR	
r	Gr	gr	
✓			

Gametes	G	g	✓
R	GR	gR	
R	GR	gR	
✓			

Step 2:**P₁** ✓

Gametes ✓	GR	Gr	gR	gr	✓ ✓
GR	GGRR	GGRr	GgRR	GgRr	
GR	GGRR	GGRr	GgRR	GgRr	
gR	GgRR	GgRr	ggRR	ggRr	
gR	GgRR	GgRr	ggRR	ggRr	
✓ ✓					

Fertilisation ✓**F₁** ✓

Genotype: 2:16 GGRR ✓ ; 2:16 GGRr ✓ ; 4:16 GgRR ✓ ; 4:16 GgRr ✓ ; 2:16 ggRR ✓ ;
2:16 ggRr ✓

Phenotype: 12 ✓ with grey tail feathers and red eyes ✓ ; 4 ✓ with white tail feathers
and red eyes ✓

(14)

[29]

SESSION 11**TOPIC: ANIMAL RESPONSE TO THE ENVIRONMENT: ENDOCRINE SYSTEM AND HOMEOSTASIS**

Teacher Note: Please ensure that the learners know the following: Knowledge and application: know what chemical co-ordination is; the differences between the endocrine and exocrine glands; basic characteristics of hormones; location and function of hormones produced by the endocrine glands; what negative feedback is; causes, prevention and symptoms of some diseases like diabetes, thyroid disorders, growth disorders and infertility; structure versus function of the different parts of the skin; how to regulate body temperature.

LESSON OVERVIEW

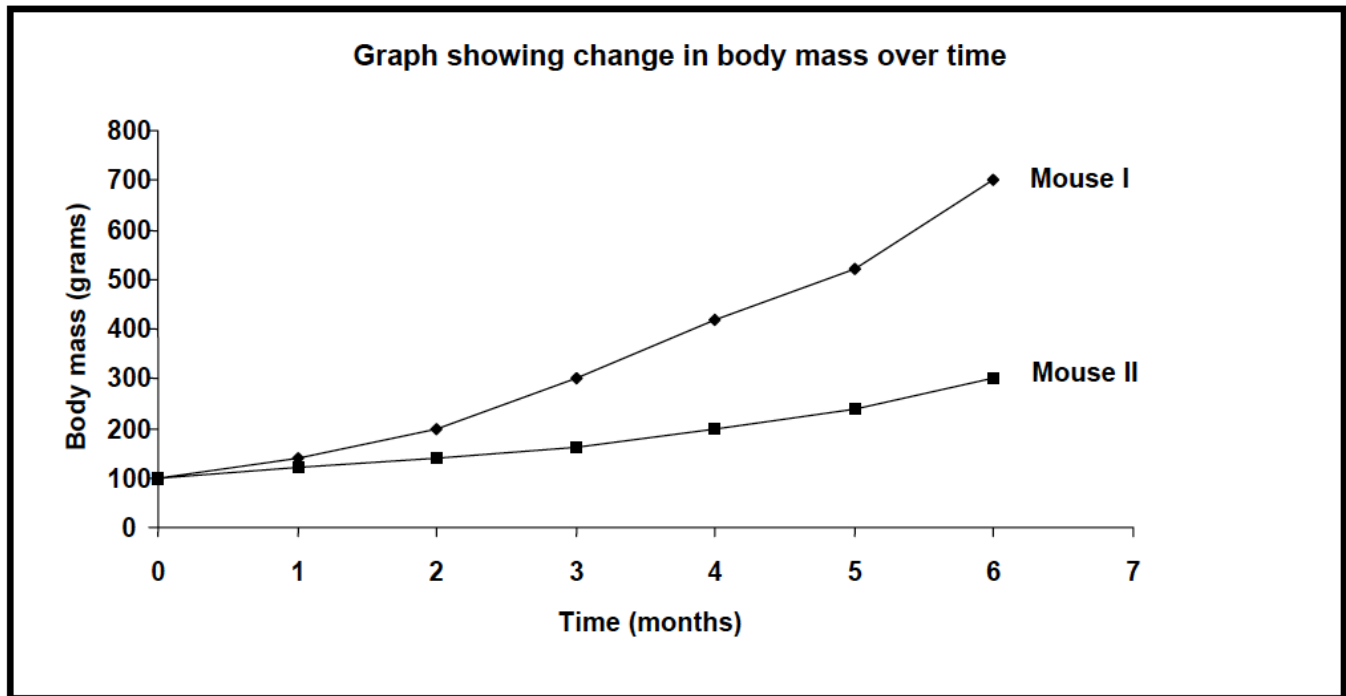
1. Introduce session: 5 minutes
2. Typical exam questions: 55 minutes
3. Review/solutions/memo: 30 minutes

SECTION A: TYPICAL EXAM QUESTIONS

QUESTION 1: 14 minutes 14 marks *(Taken from DoE May/June 2008 Paper 2)*

The graph below shows the change in mass of two young mice from the same litter (born from the same parents) over time. One of the two mice was injected with a substance secreted by an endocrine gland. Study the graph and answer the questions that follow.

HINT: For any graph question, learners must study the graph first. They must look at the heading and take note of what is being graphed. Then read the dependent (Y-axis) and independent (X-axis) variables carefully. They must always use a ruler when reading data off a graph as this will ensure that they are accurate. They must use a pencil to draw lines across the points that they are required to get information from. Where the lines cross will be the point that they are looking at. It will also show them what the readings are at the X and Y axis without error. Graphs are the easiest way to score marks. They must practise graphing skills.



- 1.1 Name the endocrine gland that secretes the substance that was injected into one of the mice. (1)
 - 1.2 Which mouse (I or II) was injected with the secretion? (1)
 - 1.3 Name the secretion that was injected into the mouse mentioned in QUESTION 1.2. (1)
 - 1.4 Explain your answer to QUESTION 1.3. (2)
 - 1.5 At what time was there approximately a hundred percent difference in mass between the two mice? (2)
 - 1.6 Explain why each of the following needs to be kept constant for the two mice during the investigation:
 - a) Temperature (2)
 - b) Diet (2)
 - 1.7 It was found that the secretion from the gland identified in QUESTION 1.1 did not have a significant effect on an adult mouse. Give a possible explanation for this. (3)
- [14]

QUESTION 2: 7 minutes 8 marks (Taken from DoE May/June 2008 Paper 2)

Give an explanation for each of the following observations made by a person watching an athletics event:

- 2.1. A light-skinned athlete participating in the 100-metre event looks pale just before the race begins (4)
- 2.2. The light-skinned athlete appears reddish immediately after the 100-metre race (4)

QUESTION 3: 10 minutes 13 marks *(Taken from DoE May/June 2008 Paper 2)*

Various changes occur in the body as a result of changes in the environment.

- 3.1. A 5 000-metre athlete and a spectator (someone sitting in the shade watching) of the same sex, age and mass have the same concentration of water in their bodies before the race.

Tabulate ONE difference between a spectator sitting in the shade and an athlete who has just run the 5 000-metre race for each of the following:

- a) State of contraction/relaxation of the hair erector muscles (2)
- b) Amount of water excreted by the kidneys immediately after the race (2)
- c) Amount of thyroxine in the blood (2)

Table (1)

HINT: When learners are asked to tabulate, they will get marks for drawing the table. They must read the question carefully because all the information that is required in their table is given in the question.

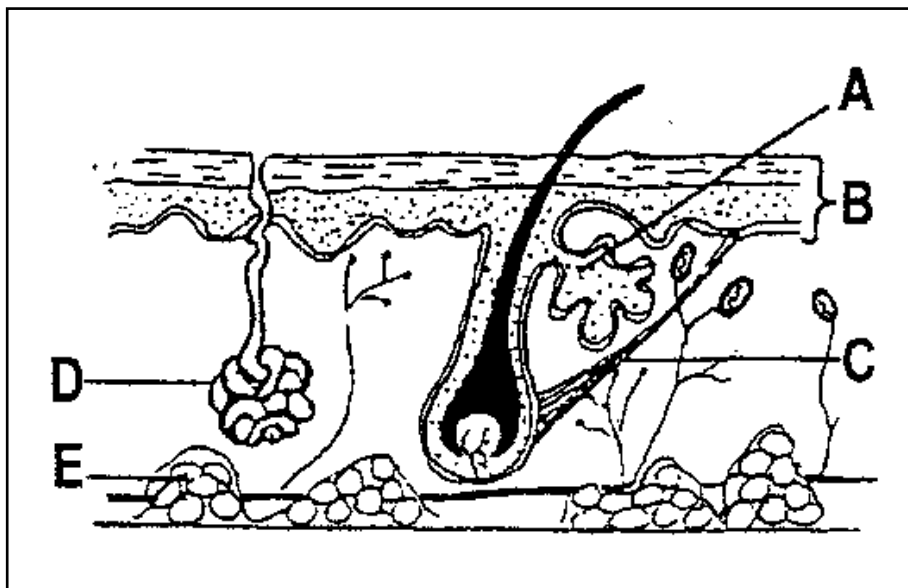
- 3.2 Explain your answer to QUESTION 3.1(b). (3)

- 3.3 State THREE ways in which heat is lost from the human body. (3)

[13]

QUESTION 4: 10 minutes 17 marks *(Taken from Bios Best 2007 HG)*

Study the diagram of the human skin and answer the questions that follow:



- 4.1. Provide labels for structures A, B, D and E. (4)

- 4.2. State ONE function of C and D respectively. (4)

- 4.3. Describe the role played by the skin in regulating blood temperature on a cold day. (9)

[17]

QUESTION 5: 15 minutes 25 marks*(Taken from Bios Best 2007 HG)*

Read the passage and then answer the questions that follow:

The way blood sugar level is controlled in the mammalian body is an example of a hormonally influenced control mechanism. A number of organs are involved in maintaining glucose at a relatively constant level in the blood. These include the liver, the pancreas, the adrenal glands and the hypothalamus.

Glucose molecules from the small intestine are absorbed into the blood and are transported to the liver. To keep the level of blood sugar constant, the liver releases small amounts of glucose into blood vessels, which run from the liver to the heart via the vena cava.

The pancreas is part of a three-part control system. The presence of glucose in the blood stimulates certain cells in the pancreas to secrete insulin. The major effect of insulin is to lower the amount of glucose in the blood.

A three-part control system “tells” the liver how much glucose should be released into the blood. Glucose molecules in the blood also act on the hypothalamus. An increase in the glucose content of the blood stimulates the hypothalamus to send inhibitory messages to the liver. On the other hand, should the glucose level drop below normal, the liver receives a signal to release more glucose.

A third mechanism helped to regulate glucose levels during strenuous exercise. As the body uses large amounts of glucose, the carbon dioxide level in the blood increases to a very high level. The liver cannot release glucose as fast as it is broken down. The hypothalamus now becomes active. It stimulates the adrenal glands to secrete adrenalin. Adrenalin acts on the liver cells, the result being an increase in the blood sugar level.

- 5.1. Define the term hormones and homeostasis. (4 x 2) (8)
 - 5.2. Which cells in the pancreas secrete insulin? (2)
 - 5.3. What stimulates the three centres of the three-part control system? (1)
 - 5.4. Explain why the interaction between the liver and the hypothalamus is referred to as a negative feedback system. (9)
 - 5.5. Apart from the hormones named in the passage, there is one other hormone that plays a major role in the utilisation of glucose. Name this hormone and describe its role in glucose metabolism. (5)
- [25]

SECTION B: SOLUTIONS AND HINTS TO SECTION A**QUESTION 1**

- 1.1 Hypophysis / Pituitary (1)
- 1.2 Mouse I (1)
- 1.3 - Growth hormone (GH) / Somatotrophic hormone (STH) (1)
- 1.4 - For the same time period (1)
- it showed a greater increase in mass (2)
- 1.5 Fourth / 4th ✓ month (2)
- 1.6 (a) - Lower temperature ✓ for either of the mice (2)
- will cause more food to be oxidised / increased metabolic rate ✓ and less food will be available for growth
- (b) - Less food ✓ available for either of the mice
- will lead to a smaller body mass since food is used ✓ for growth
- OR**
- Different food types ✓
- contribute differently to the growth ✓ of an organism (2)
- 1.7 - One of the target organs of GH is bone ✓
- Bone length cannot be increased ✓ in adult mice
- because bone growth has stopped ✓
- OR**
- One of the target organs of GH is bone ✓
- adult mice don't need ✓ to grow any more ✓ (3)
- [14]**

QUESTION 2

- 2.1 - More blood needed by muscles ✓
- to provide sufficient oxygen ✓
- and glucose ✓
- for oxidation to provide energy. ✓
- The arterioles in the skin are thus constricted ✓
- causing less blood to reach the skin ✓ (Mark Any 4) (4)
- OR**
- Nervous ✓
- therefore, adrenalin produced ✓
- therefore less blood to skin ✓
- more blood to muscles ✓ (Mark Any 4) (4)
- 2.2 - Increased respiration/oxidation ✓ during race
- generates a large amount of heat. ✓
- The arterioles in the skin dilate ✓
- to allow more blood with heat ✓ to reach the skin
- so that excess heat can be lost to the environment ✓ (Mark Any 4) (4)
- [8]**

QUESTION 3

3.1.

	Spectator	Athlete
(a)	Contracted ✓	Relaxed ✓
(b)	More ✓	Less ✓
(c)	Less ✓	More ✓

(6) + **TABLE** = (1)

(7)

3.2 - Athlete sweats more ✓

- to use more body heat ✓ to evaporate sweat

- in order to cool down the body/lower the body temperature ✓

OR

- Spectator sweats less ✓

- therefore, less body ✓ heat used to evaporate sweat

- because he is less active/his body temperature is not very high ✓

(3)

3.3 - Radiation ✓

- Convection ✓

- Evaporation ✓

- Urination ✓

- Defecation ✓

- Expiration / Breathing ✓

(Mark first 3 answers only)

(3)

[13]**QUESTION 4:**

4.1. A = oil gland / sebaceous gland

B = epidermis

D = sweat gland

E = subcutaneous fat tissue / adipose tissue

(4 x 1)

(4)

4.2. C = erector muscle: when the erector muscle contract (1), it pulls the hair up to a more vertical position (1) to trap warm air

(2)

D = the sweat gland: secrete sweat (1) to cool the body by evaporation (1)

(2)

QUESTION 4

- 4.1. A = oil gland / sebaceous gland
 B = epidermis
 D = sweat gland
 E = subcutaneous fat tissue / adipose tissue (4 x 1) (4)
- 4.2. C = erector muscle: when the erector muscle contract, ✓ it pulls the hair up to a more vertical position ✓ to trap warm air (2)
 D = the sweat gland: secrete sweat ✓ to cool the body by evaporation ✓ (2)
- 4.3. The body gets cold:
- **Less** water is needed in the blood ✓ because you do not need to produce sweat
 - **Less** ADH is released by the pituitary gland ✓ to keep **less** water in the blood ✓
 - Blood vessels near the surface of the skin **constrict** (vasoconstriction), ✓ so **less** blood reaches the sweat glands ✓
 - Sweat glands produce less sweat ✓
 - **No** sweat evaporates, so there is no cooling of the skin and the blood in the surface vessels ✓
 - This means that **less** concentrated urine (dilute urine) is produced ✓
 - The hairs in the skin are **pulled upright** by the erector muscles to trap warm air ✓ (9)
- [17]

QUESTION 5

- a. **Hormones:** are organic chemical messenger, ✓ that are secreted by ductless ✓ endocrine glands and carried by the blood ✓ to a target organ. ✓
Homeostasis: is the maintenance ✓ of a relatively constant ✓ internal environment for normal tissue functioning, ✓ controlled by the autonomic nervous system. ✓ (8)
- 5.2. Beta cells ✓ of the Islets of Langerhans in the pancreas (1)
- 5.3. the presence of glucose in the blood / blood glucose level. ✓ (1)
- 5.4.
- There is a negative feedback mechanism ✓ between the liver and the hypothalamus.
 - When the blood glucose level is low, ✓ the hypothalamus stimulates the liver ✓ to convert glycogen to glucose ✓ to increase the blood glucose level. ✓
 - When the blood glucose level is high, ✓ the impulses from the hypothalamus will be limited, ✓ causing the liver to decrease the conversion of glycogen to glucose, ✓ resulting in a decrease in the blood glucose level. ✓ (9)
 - Thyroxin regulates the basal metabolic rate of a person. ✓ With increased thyroxin secretion, the basal metabolic rate is increased. ✓
 - Thyroxin stimulates the use of oxygen and glucose for respiration ✓
 - Thyroxin accelerates cellular metabolism and therefore energy release (ATP and heat) ✓ Thyroxin stimulates protein synthesis which has an effect on growth in. ✓
 - Thyroxin promotes the breakdown and use of fats ✓
 - Thyroxin stimulates the excretion of cholesterol in bile, which lowers the blood cholesterol levels ✓
 - Increased levels of thyroxin will inhibit the pituitary gland from releasing TSH. ✓
- (Mark any 5 points) (5)
- [25]

SECTION C: HOMEWORK**QUESTION 1**

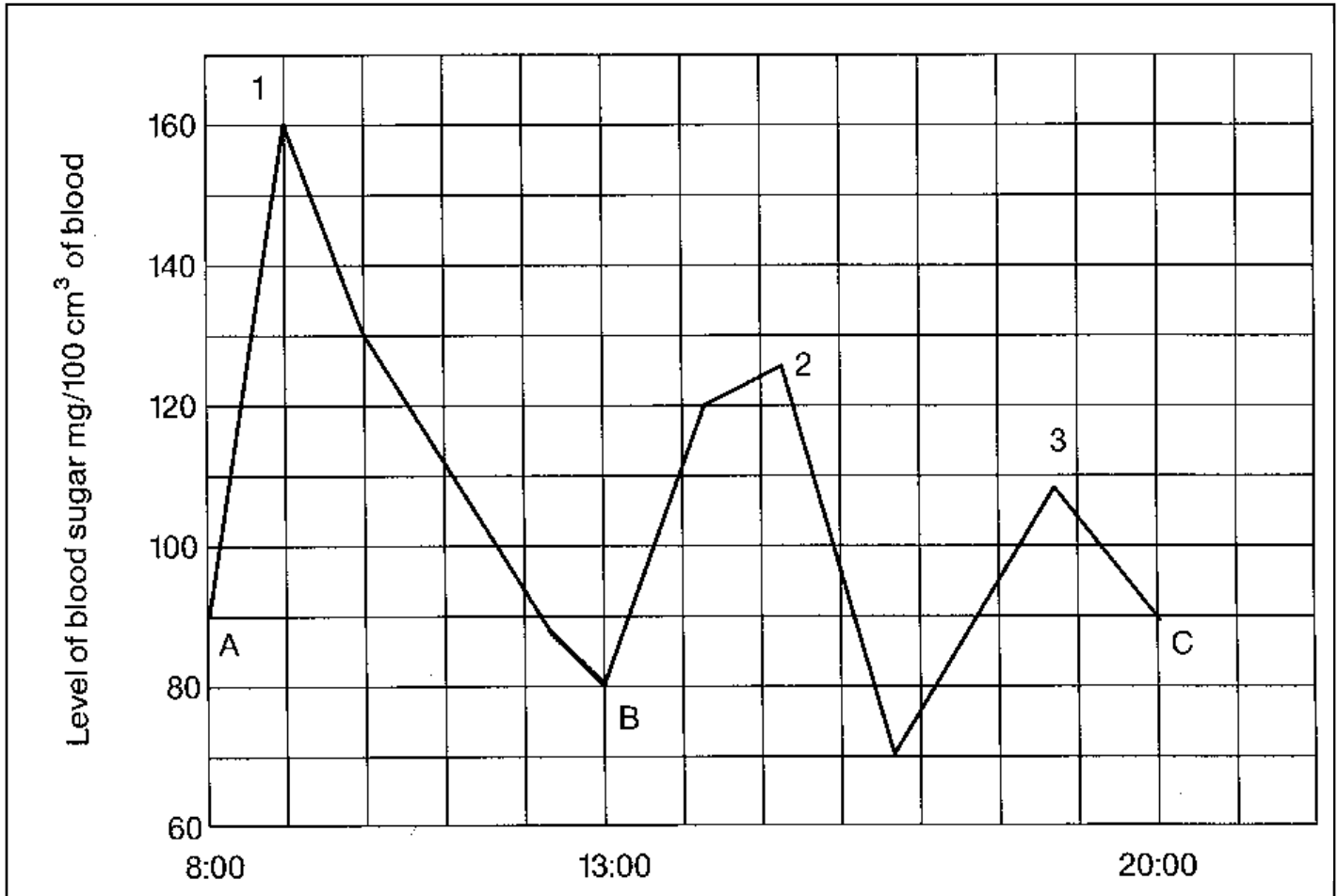
Write down the correct biological term for each of the following descriptions.

1. The secretions that are produced in small quantities by endocrine glands.
2. The endocrine gland which controls the hormonal secretions of most of the other endocrine glands.
3. The endocrine gland that can be regarded as the 'master gland' in the human body.
4. A system of all the hormone-secreting glands in the human body.
5. An enlarged thyroid gland, resulting from an iron deficiency.
6. The pair of endocrine glands located just above each kidney.
7. A disease in which the hormonal control of blood glucose is defective because of an absolute or relative deficiency of insulin.
8. The hormone secretion of the islets of Langerhans which lowers the glucose level in the blood.
9. The system informing the human body of changes in its internal and external environment.
10. The endocrine gland which secretes adrenalin.
11. The autonomic response to a stimulus which is not under conscious control.
12. The secretion of the thyroid gland.
13. The hormone that stimulates the secretion of the hormone of the thyroid gland.
14. The hormone that prepares the body for an emergency.
15. An aspect of the control system in which the ultimate effects of the system will counteract the original stimulus.

[15]

QUESTION 2

The graph below shows the level of the blood sugar of a healthy person during a 12 hour period. Study the graph and answer the questions that follow:



- 2.1. At what time of day is the level of the blood sugar:
 - a) the lowest and (1)
 - b) the highest? (1)
- 2.2. What is the level of the blood sugar at:
 - a) 10:00 and (1)
 - b) 16:00? (1)
- 2.3. During which hour is the level of the blood sugar:
 - a) 140mg/100 cm³, and (1)
 - b) 75mg/100 cm³ blood? (1)
- 2.4. During which hour was the rate of increase in the level of blood sugar:
 - a) the greatest and (1)
 - b) the smallest? (1)
- 2.5. What occurred at point **A** and **B** on the graph to cause the subsequent changes in the levels of the blood sugar? (4)

- 2.6. At points 1, 2 and 3 on the graph, the concentration of blood sugar drops.
- Which hormone is responsible for the decrease in concentration? (1)
 - Where in the body is this hormone produced? (2)
- 2.7. There is an increase in the concentration of the blood sugar between 17:00 and 18:00.
- Which hormone is responsible for this increase? (1)
 - Where in the human body is this hormone produced? (2)
 - Briefly describe the role played by this hormone mentioned in Question 2.7 b) in decreasing the level of the blood sugar. (4)
- 2.8. At 20:00 the person got a fright/was frightened.
- What do you expect to happen to the level of the blood sugar at point **C**? (1)
 - Which hormone is involved now? (1)
 - Where in the human body is this hormone produced? (1)
 - What are the effects of the hormone mentioned in Question 2.8 c) on the person's body in times of fright? (5)
 - Which part of the autonomic nervous system produced similar effects on the human body to those mentioned in Question 2.8 d)? (1)
- 2.9. What is the pathological condition called when the sugar level in the blood is abnormally high? What would the normal level be? (2)

[33]

SECTION D: SOLUTIONS TO HOMEWORK SESSION 10

QUESTION 1

- Hormones
- Pituitary gland / hypophysis
- Pituitary gland / hypophysis
- Endocrine
- Goitre
- Adrenal glands
- Diabetes
- Insulin
- Nervous system
- Adrenal glands
- Reflex action
- Thyroxin
- TSH
- Adrenalin
- Negative feedback

(15 x 1) **[15]**

- 1.2. **Week 1 to 3:** Growth is slow because the animals are adjusting / acclimatising ✓
 – lag phase. ✓
Week 4 to 8: Increase in population – accelerated growth phase. ✓ There is
 enough food, shelter and space/ there are no limiting factors. ✓
Week 8 to 10: Deceleration phase ✓- population growth is slower ✓
Week 11 to 13: Equilibrium phase ✓- carrying capacity is reached ✓
Week 14 to 15: Death phase ✓- environmental resistance causes population
 size to decrease ✓ (10)
- 1.3. Intra-specific ✓ Organisms of the **same** species are competing. ✓ (2)
- 1.4. 120. ✓ The natality rate = the mortality rate ✓ (2)
- 1.5. A predator will cause the population to decrease ✓ and give the environment a
 chance to improve the carrying capacity. ✓ [25] (2)

QUESTION 2

- 2.1. Competition for food and water ✓/ competition for space ✓/ spread of
 disease ✓ (Any two) (2)
- 2.2. Drought / cold / veldfires ✓ (Any one) (1)
- 2.3. Intraspecific competition ✓
 Competition for resources between individuals ✓ belonging to the same
 species ✓ (3)
- 2.4. K-strategy ✓
 They produce few offspring ✓/ supply good parental care ✓ (Any one) (1)
- 2.5. 30 000 springbuck ✓ (1)
- 2.6. Overgrazing ✓/ trampling which causes soil erosion ✓ (Any one) (1)
- 2.7. Reintroduce predators ✓/ cull the springbuck ✓ / hunting ✓/ relocate
 springbuck to other areas for a period ✓ (Any two) (2)
- 2.8. Regulating the springbuck population naturally ✓ to ensure a stable
 population ✓
OR
 Predators would have been a stabilising factor ✓
 (Only 1 mark for the second option) (2)
- 2.9. Secondary succession ✓✓ (2)

[16]