**SENIOR SECONDARY IMPROVEMENT PROGRAMME 2013**

**GRADE 12**

**LIFE SCIENCES**

**LEARNER HOMEWORK SOLUTIONS**

# TABLE OF CONTENTS


# LEARNER HOMEWORK SOLUTIONS

.

| SOLUTIONS TO HOMEWORK: SESSION - SELF STUDY |
| --- |
| TOPIC 1: CONSOLIDATION EXERISES - MEIOSIS AND DNA |

## 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          *(Mark first ONE only)* | (1) |

**[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]**

---

**SOLUTIONS TO HOMEWORK: SESSION -  SELF STUDY**

**TOPIC 2: CONSOLIDATION EXERISES - MEIOSIS AND DNA FINGERPRINTING-**

---

## QUESTION 1

1.1     Anaphase II✓                                                                          (1)

1.2     (Sister) chromatids✓/(daughter) chromosomes are moved✓/pulled
         towards the poles                                                                     (2)

1.3     A     Spindle✓fibre
         B     Cell membrane✓                                                                  (2)

1.4     (a)                                                                                    (1)

         (b)                                                                                   (1)

1.5     Ovary✓/germinal epithelium/follicle                                                   (1)
1.6     No✓                                                                                    (1)
1.7     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]**

This diagram shows only 4 chromosomes✓/8 chromatids /incorrect number of
chromosomes                                                              (2)

---

**SOLUTIONS TO HOMEWORK: SESSION %\$**

**TOPIC 1: MENDEL'S 1st LAW**

---

## QUESTION 1

1.1.    Black = B      White = b

**P¹ √    Bb  x  Bb      -      Meiosis √**

| Gametes | B | b | |
|---------|----|----|----|
| **B** | BB | Bb | √ |
| **b** | Bb | bb | √ |
| √ | | | |

**Fertilisation √**

**F¹ √**

**Genotype:**    1:4 Homozygous black – BB √ ,  2:4 Heterozygous black – Bb √ ,
1:4 Homozygous white – bb √

**Phenotype:**  75% black {1 homozygous black √ + 2 heterozygous black} √
25% white {1 homozygous white} √ **(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]**

## QUESTION 2

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 punnit 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]**

---

**SOLUTIONS TO HOMEWORK: SESSION %$**

**TOPIC 2: MENDEL'S 2nd LAW**

---

## 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   √**          **'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:**   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]**

---

**SOLUTIONS TO HOMEWORK: SESSION %‰**

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

---

**QUESTION 1**

1. Hormones
2. Pituitary gland / hypophysis
3. Pituitary gland / hypophysis
4. Endocrine
5. Goitre
6. Adrenal glands
7. Diabetes
8. Insulin
9. Nervous system
10. Adrenal glands
11. Reflex action
12. Thyroxin
13. TSH
14. Adrenalin
15. Negative feedback                              (15 x 1)**[15]**

**QUESTION 2**

2.1.  a)  16:40 ✓                                  b)  09:00 ✓                  (2)

2.2.  a)  130 mg/10 cm$^3$ blood ✓     b)  98 mg/100 cm$^3$ blood ✓     (2)

2.3.  a)  08:00 to 09:00 ✓              b)  16:00 to 17:00 ✓            (2)

2.4.  a)  08:00 to 09:00 ✓              b)  15:00 to 16:00 ✓            (2)

2.5.  After a meal rich in carbohydrates ✓, digestion takes place ✓and glucose is absorbed into the blood stream ✓thereby increasing ✓the blood sugar level.     (4)

2.6.  a)  Insulin ✓                                                              (1)

   b)  Beta cells ✓of the Islets of Langerhans in the pancreas ✓            (2)

2.7.  a)  glucagon ✓                                                            (1)

   b)  alpha cells ✓of the Islets of Langerhans in the pancreas ✓           (2)

   c)
   - Glucagon secretion is stimulated by a low blood sugar level ✓
   - Glucagon is transported to the liver by the blood ✓
   - It stimulates the conversion of glycogen to glucose ✓
   - Causing the blood sugar level to rise/increase ✓                       (4)

2.8.    a) will rise ✓                                                                                    (1)

b) adrenalin ✓                                                                                    (1)

c) adrenal medulla ✓                                                                        (1)

d)

- Inhibits the action of the viscera in the stomach and the small intestine ✓
- Constricts blood vessels to the skin (skin becomes pale) ✓
- Increases the heartbeat rate and speeds up circulation ✓
- Raises blood pressure (blood vessels are constricted) ✓
- Causes the liver to convert more glycogen to glucose to increase the blood sugar level ✓
- Causes the liver to release stored red blood cells to transport more oxygen to the muscle tissue ✓
- Dilates the bronchi and increases the rate and depth of breathing (more oxygen into the blood) ✓
- Increases the metabolic rate so that more energy is released by the muscle cells✓                                                    **(Mark any 5)**        (5)

e) Sympathetic nervous system ✓                                                    (1)

2.9.    Diabetes mellitus ,✓ 100 mg/100 cm$^3$ blood ✓                              (2)

                                                                                                       **[33]**

| | | | |
|---|---|---|---|
| 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. ✓ | | (2) **[25]** |

**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]**