



NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

LIFE SCIENCES: PAPER II

MARKING GUIDELINES

Time: 2 hours

100 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matter of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at the standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A

QUESTION 1

1.1 1.1.1 Hormone

1.1.2

Chemical Messenger	ONE Function	Stimulatory or inhibiting
FSH	Activates/stimulates germinal epithelium (in the testes) to start sperm cell production Activates/stimulates Sertoli cells to produce proteins/nutrients to regulate/maintain sperm development	Stimulating
LH	Causes cells in testes / testes / Leydig cells to produce testosterone	Stimulating
Testosterone	(in Sertoli cells) 1. Assists in the maturation of sperm OR Contributes to the quality of sperm OR Regulates sperm production (spermatogenesis)	Stimulating
	2. Stops/prevents pituitary gland from further FSH/LH production/secretion.	Inhibiting

1.1.3 (a) diploid/2n

(b) haploid/n

- 1.2 1.2.1
- Easy administration.
 - Cause infertility within 4 weeks of use.
 - Fertility must be restored easily/quickly after discontinuation.
 - Must not negatively impact sex drive.
 - Must not negatively influence homeostasis / hormonal feedback loops / hormonal levels.
 - Must not cause organ damage.
 - Must prevent pregnancy.

(Any 2 × 1)

- 1.2.2
- Women have 13 (available) contraceptive methods, men have 3.
 - Female contraceptive methods are expensive / require doctor's visits / prescriptions / not covered by medical aid.
 - Female hormonal contraceptives cause negative side effects / mood changes / emotional burden / health risks.
 - Male contraceptive options are limiting / have to rely / depend on women's contraceptive use / choices.
 - Male contraceptive options have risk of failure/irreversible.

(Any 2 × 1)

1.3 1.3.1 Any feature and its correctly described function.

- **Acrosome** – (sac containing lytic) enzymes that dissolve the (yolk/vitelline) membrane of the ovum – to allow for penetration to occur.
- **Arrow shaped head** – streamlined shape – for faster swimming to the ovum/for penetration into the ovum.
- **Midpiece** containing many mitochondria / Many mitochondria – provide energy for locomotion/swimming – to allow sperm to travel the long distance to the ovum for fertilisation.
- **Tail** long / capable of whip-like movements – propels sperm (through seminal fluid) – allowing sperm to reach the ovum (in the fallopian tube) for fertilisation.

- 1.3.2 (a)
- The motility/swimming ability of the sperm cells would be interfered with/sperm cells would lose the ability to swim straight/properly.
 - Sperm cell/spermatid maturation would be prevented.

(Any 1 × 1)

- (b)
- (i) Thermoregulation/regulate the temperature of the testes in cold weather scrotum tightens to draw testes closer to the body for warmth.
Accept: Protection of the testes.
- (ii) The optimal / best / favourable temperature for sperm production is 2/3 °C lower than that of the (human) body. Raising the testes closer to/almost inside the body would raise the temperature of the testes to above this optimal temperature/37 °C required for healthy sperm production.

(Any 2 × 1)

- (c) **Similarity:** Sperm is unable to travel from the testes/epididymis through the sperm ducts and out the urethra/penis.

Difference: Vasectomy is permanent / cuts / severs sperm ducts; 'plugs' are temporary/a removable plug is inserted into both sperm ducts.

1.3.3 (a) Percentage change = $\frac{\text{Original} - \text{New}}{\text{Original}} \times 100$

Percentage change = $\left[\frac{(32-3)}{32} \times 100 \right]$ method

Percentage change = 90,6 (%)

(Answer must be given to one decimal place)

ORIGINAL: Sperm motility at 0,1 mg/kg B.W. – >30 and <35

NEW: Sperm motility at 0,4 mg/kg B.W. – >0 and <5

Range of answers: 87,1 – 97,0 (%)

- (b) The lesser the sperm motility (%)
the lower the pregnancy rate (%)
(both points are required for the answer to be correct)

- 1.4 Explanation of the hormonal effects of decrease in testosterone +
2 outcomes/features of low testosterone

2 × 1 Facts explaining:

- Negative feedback loop to pituitary gland.
- Results in more FSH/LH – impacts Sertoli/Leydig cells.

2 × 1 Facts/Outcomes:

- Results in reduction in sperm production.
- Testes shrinkage.
- Negative impact on male secondary sexual characteristics.
- Low-term/permanent infertility.
- Reduction in sex-drive.

1.5 Yes:

- Prevents/alleviates (further) human population growth.
- Prevents/alleviates negative side effects of (existing) human contraceptives.
- Addresses contraceptive injustice.
- Biologists/Scientists cannot conduct experiments without living organisms.
- Previous research (on the herb) caused low sperm counts / deformed sperm / negative side effects in human males.
- The animals/mammals suffered no (detectable) organ damage/altered hormonal changes/permanent infertility.
- Potentially dangerous drug trials in their early stages with unknown side effects should not be tested on humans.
- Humans are also mammals so will have similar effect/can draw comparison.

OR

No:

- Reliability of animal experiments for extrapolation to human health is questionable.
- Mammals have (well-developed) nervous systems/(high capacity to) experience pain.
- Organ damage can only (reliably) be determined through performing surgery/autopsy on many animals (without consent/no choice).
- It is unknown / not disclosed how many dosages trials / dosage concentrations / other compound trials were undertaken before positive results were achieved many mice/monkeys would have died/suffered to achieve this end.
- Human volunteer studies rather than animal trials should be conducted.
- Animal rights violations.

(Candidate must choose either a 'yes' or 'no' argument and provide 2 × 1 valid ethical reasons to support their choice)

QUESTION 2

2.1

COLUMN 1	COLUMN 2	ANSWER
Cross-pollination	1. Transfer of pollen from the anther of a flower to the stigma of another flower of the same plant. 2. Transfer of pollen from the anther of a flower on one plant to the stigma of a flower on another plant of the same species.	2
Seedbank	1. A facility that buys and sells valuable seeds to wealthy farmers. 2. An area on a farm where the previous seasons' seeds are stored.	none

2.2 2.2.1 (a) A seed: ovule

(b) A fruit: ovary

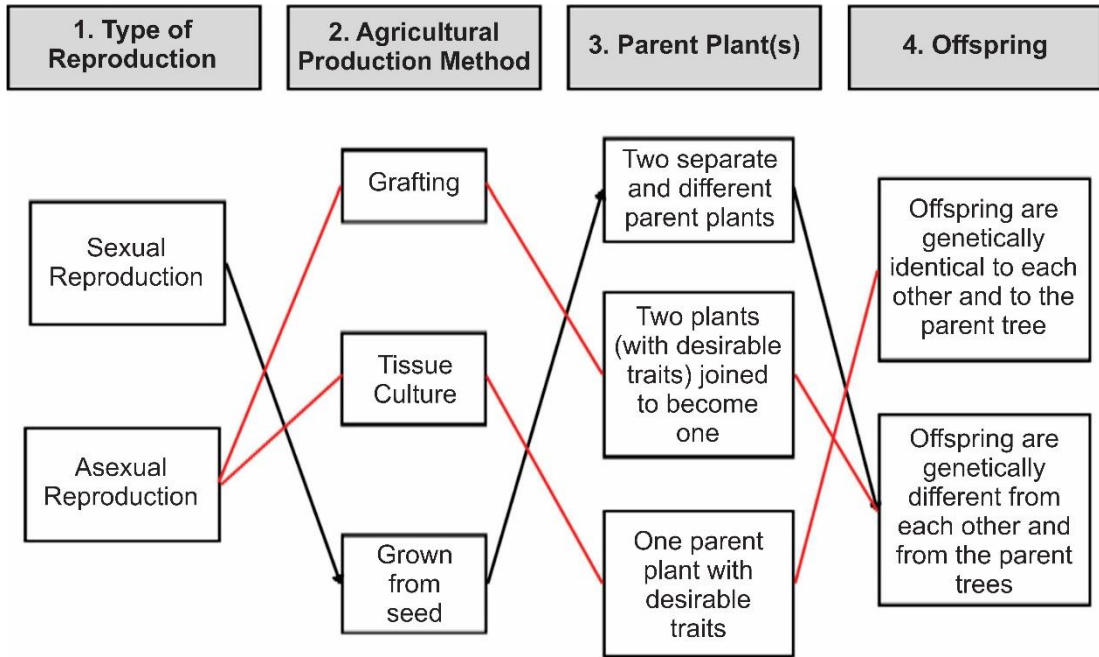
2.2.2 (a) With seed-grown trees yielding 50 000 to 90 000 (fruits annually)

(b) Increased likelihood of fertilisation/pollination.
Leading to increased seed/fruit production.

- 2.2.3
- Need to grow separate male and female trees for cross-pollination to occur / very expensive/need large amounts of land/large number of trees to make it profitable/to make money.
 - Seeds can remain dormant in the soil for over six months/seeds take a long time to germinate / it can take many years before trees are producing income.
 - Seedlings take 6–10 years to produce first fruits/it takes a long time for first fruit production to occur / it can take many years before trees are producing income.
 - Seeds have a tough protective covering that can be a barrier to germination / it can take many years before trees are producing income.
 - Seedlings are more vulnerable to lack of water / pests / disease / large cost outlay before income is received.

(Any 1 × 1 explanation)

2.3 2.3.1



for each line (red) correctly drawn

2.3.2 Disadvantages:

- Requires use of a rootstock grown from seed. Seed germination for rootstock can take a long time/up to 6 months.
- Tissue layers of rootstock and scion must fuse. Potential of graft failure due to drying out / disease / tissues dying.

(Any 1 × 2 or 2 facts)

- 2.3.3 (a) (i) laboratory / artificial / unnatural
- (ii) Somatic / body / leaf / leaf explants / diploid
- (iii) (growth) hormones

- (b) Measurements:
 XY = 31 mm (accept 28–33 mm)
 Scale bar = 9 mm (accept 7–11 mm)
 Magnification = 9x (9 mm/1 mm)

$$\text{Actual length} = \frac{\text{Length of XY}}{\text{Magnification}} = \left(\frac{31 \text{ mm}}{9x} \right) (\text{method}) = 3,44 = 3 \text{ mm}$$

OR

$$\text{Actual length} = \frac{\text{Length of XY}}{\text{Length of scale bar}} \times \text{scale bar} =$$

$$\left(\frac{31 \text{ mm}}{9x} \right) \times 1 \text{ mm (method)} = 3,44 = 3 \text{ mm}$$

(Answer must be given as a whole number AND with the correct units)

Accepted answers – 3 mm OR 4 mm

- 2.4 Candidate must link agricultural production to improving social AND economic aspects of rural southern Africa.

For Example:

The farming/growing marula trees as a crop/many trees in one area can be managed more effectively, leading to higher yields (of fruit / leaves / bark / seeds)/diversification of products (e.g. pulp and juice products: Alcoholic beverages / beer / Amarula cream **OR** juices/jams).

Increased income generation from high yields/multiple sources of revenue would lead to improved social welfare / education / quality of life / life expectancy.

OR

The farming/growing marula trees as a crop/many trees in one area can be managed more effectively, leading to higher yields / higher income generation of from leaves / bark / seeds for traditional medicine.

The medicinal benefits of the marula tree products (used to treat diabetes / malaria / pain / fever / infection) ensure that rural communities are less dependent/need for expensive (western) medicine.

OR

The agricultural production of marula trees could lead to higher yields/more consistent fruit quality, ensuring more (consistent) revenue generation from the sale of fruits for food / juice / alcohol manufacturing. High/consistent fruit yields also reduce food insecurity, providing a nutritious food source/high in protein, vitamin C and key minerals (to reduce hunger when alternate sources are low).

OR

The agricultural production of marula trees could lead to higher fruit yields/more consistent fruit quality ensuring more consistent revenue generation from the sale of a variety of products / fruits for food / juice / alcohol manufacturing. High and consistent fruit yields also provide nutritional benefits (Vit. C / E / Ca / Mg / protein / P / K / oils) which results in improved health and immunity/less illness in rural communities.

OR

The marula tree is naturally pest resistant / requires less water / adapted to local environment / grows well in drier rural areas. The fruit / seed / leaf / bark yield from its agricultural production, therefore, is more reliable. Ensuring increased income generation in rural areas due to the multiple sources of revenue that can be generated. This then leads to improved social welfare / education / quality of life / life expectancy in these areas.

2.5 2.5.1 The seed has a tough protective covering/stony outer layers.
Seeds can remain dormant in the soil for over 6 months.
*Seeds can be stored for long periods/up to four years.
(any 1 × 1 + *Compulsory)

2.5.2 Provides a bank of marula genetic resources from which:

- Plant breeders need to increase yield / disease resistance / drought tolerance.
- Plant breeders can develop new and improved cultivars with desirable characteristics.
- High genetic diversity is available to allow for breeders to select for traits beneficial to future climatic changes.
- The different commercial products can each acquire different cultivars/different trait selection from.
- Key traits can be reintroduced to maintain genetic diversity/to avoid inbreeding (depression).
- If trees threatened by extinction/affected by disease can be reintroduced as a crop.

(Any 2 × 1)

SECTION B

QUESTION 3

Note: The following table represents facts from the Source Material that can be awarded for the supporting argument under the 'use of knowledge from sources' category of the marking rubric, as well as counter argument facts from the Source Material that can be awarded for the 'Fairness – counter opinions to decision' category of the marking rubric.

FOR	AGAINST
Exposure to EDCs IS the main cause of a decrease in human fertility	Exposure to EDCs IS NOT the main cause of a decrease in human fertility
ENDOCRINE DISRUPTORS	
<p>EDCs: (A)</p> <ul style="list-style-type: none"> even small amounts can interfere with hormones that control reproduction <p>Effects on men: (A) / (C)</p> <ul style="list-style-type: none"> decreased sperm counts reduced sperm quality lowered / altered testosterone / hormone production altered sperm structure/transport <p>Oxidative stress: (A)</p> <ul style="list-style-type: none"> EDCs reduce ability of antioxidants to neutralize ROS 	<p style="text-align: center;">Primary/Secondary hypogonadism (30-40)</p>
FERTILITY TRENDS	
<p>Population Density: (B)</p> <ul style="list-style-type: none"> Environmental pollutants 	<p>Population Density: (B)</p> <ul style="list-style-type: none"> LIC – high fertility rates HIC – below-replacement fertility Reduced fertility with increased population density / Stress / Environmental pollutants <p>Personal Choices: (F)</p> <ul style="list-style-type: none"> HICs – age of having 1st child increasing
HORMONAL FACTORS	
<p>Primary causes of infertility (males): (C)</p> <ul style="list-style-type: none"> 30–40% due to decreased testosterone production 1–2% due to disrupted pituitary gland <p>EDCs can: (D) / (C)</p> <ul style="list-style-type: none"> alter / mimic / block the bodies normal production of reproductive hormones (also (A)) delay puberty damage oocytes reduce oestrogen production cause DNA mutations negatively affect foetal development / Uterine disorder <p>Polycystic Ovaries: (D)</p> <ul style="list-style-type: none"> BPA linked with PCOS 	<p style="text-align: center;">Oocyte / ovulatory disorder (~40%)</p>
ENVIRONMENTAL FACTORS	
<p>EDC contamination via: (A)</p> <ul style="list-style-type: none"> Contaminated food/water Inhaling polluted air/household dust Through skin contact with cosmetics and plastics <p>Causes of infertility in males and females: (C)</p> <ul style="list-style-type: none"> 40–50% of male infertility include exposure to toxins effects 	<p>Causes of infertility in males and females: (C)</p> <ul style="list-style-type: none"> 40–50% of male infertility includes diet / smoking / alcohol effects 10% of female infertility include diet / smoking / alcohol / exercise effects <p>POF: (E) Causes:</p> <ul style="list-style-type: none"> Chemotherapy/radiation

<ul style="list-style-type: none"> 10% of female infertility include exposure to toxins effects 	
<p>POF: (E)</p> <ul style="list-style-type: none"> EDCs may promote multi-oocyte follicles – which could lead to POF 	<p>Radioactivity: (E)</p> <ul style="list-style-type: none"> Can damage sperm/oocytes Reduce oocyte supply Lead to early menopause Harm ovarian tissue Increase miscarriage risk <p>Heavy Metal Exposure: (E)</p> <ul style="list-style-type: none"> Disrupt hormone signals Damage reproductive cells
LIFESTYLE FACTORS	
<p>EDC primary sources: (A)</p> <ul style="list-style-type: none"> Fatty meat of animal products All food items stored in plastics and food cans/ processed foods Personal care products Crops Water 	<p>Polycystic Ovaries: (D)</p> <ul style="list-style-type: none"> Linked to obesity <p>POF: (E) Causes:</p> <ul style="list-style-type: none"> Smoking/toxins <p>Maternal Age: (F)</p> <ul style="list-style-type: none"> Infertility increases with maternal age <p>Personal Choices: (F)</p> <ul style="list-style-type: none"> Professional careers contribute to delayed childbirth <p>Lifestyle Habits: (F)</p> <ul style="list-style-type: none"> High caffeine = reduced ability to conceive Smoking = increased risk of miscarriage / reduces sperm count / motility Alcohol = decrease in pregnancy rate/ spontaneous abortion <p>Nutritional Factors: (F)</p> <ul style="list-style-type: none"> High sugar / high carbs / dairy / processed meat / vegan / trans fatty acids / soy foods reduce fertility
GENETIC FACTORS	
<p>Genetic: (G)</p> <ul style="list-style-type: none"> EDCs cause genetic mutations that are inherited Male germ cells more vulnerable genetic mutations because of EDCs 	<p>Causes of infertility in males and females: (C)</p> <ul style="list-style-type: none"> 40–50% of male infertility includes genetic effects 10% of female infertility include genetics effects <p>Polycystic Ovaries: (D)</p> <ul style="list-style-type: none"> Linked with genetic factors <p>POF: (E) Causes:</p> <ul style="list-style-type: none"> Genetic mutations <p>Genetic: (G)</p> <ul style="list-style-type: none"> ✓ 30% of cases of infertility ✓ Named inherited genetic condition
<p>OWN:</p> <ul style="list-style-type: none"> Correct application of Pituitary-ovarian hormonal feedback system (with correct hormones and functions named) (Can use from Q1) Correct explanation of gene mutation Correct explanation of sex-linked genetic inheritance Correct explanation of effect of altered sperm structure, mobility on fertility Correct explanation of outcome of too much oestrogen on feedback mechanisms Smoking is an EDC 	<p>OWN:</p> <ul style="list-style-type: none"> Correct explanation of gene mutation Correct explanation of sex-linked genetic inheritance Correct explanation of insulin resistance hormonal feedback disruption (and impact on fertility for integration) Correct explanation of endometriosis (and impact on fertility for integration) Correct descriptions of STIs and impact on fertility

Total: 100 marks

Note: Essay should be 2½ to 3 pages long.

Suggested allocation of time: Reading sources 10 min.; Planning 10 min.; Writing essay 40 min.

	1 mark	2 marks	3 marks	4 marks	Possible mark
Planning x 2	<ul style="list-style-type: none"> Decision given Key points present for and against the argument 	<ul style="list-style-type: none"> Decision given Key points developed for and against the argument 	<ul style="list-style-type: none"> Decision given Key points developed for and against the argument Source references identified 		6
Decision	<ul style="list-style-type: none"> Vague Changed position within essay 	<ul style="list-style-type: none"> Clear decision made 			2
Use of knowledge from sources [x 2]	<ul style="list-style-type: none"> Up to ¼ of potential detail in sources used to support argument 	<ul style="list-style-type: none"> Up to ½ of potential detail in sources used to support argument 	<ul style="list-style-type: none"> Up to ¾ of potential detail in sources used to support argument 	<ul style="list-style-type: none"> Source detail – very close to full potential used to support argument 	8
Use of own knowledge	<ul style="list-style-type: none"> Some facts beyond the source given to support argument 	<ul style="list-style-type: none"> Many facts beyond the source given to support argument 	<ul style="list-style-type: none"> Some facts beyond the source given to support argument Facts integrated into the argument 	<ul style="list-style-type: none"> Many facts beyond the source given to support argument Facts integrated into the argument 	4
Content relevance	<ul style="list-style-type: none"> Repetition mostly avoided Some minor digression Supporting argument relevant 	<ul style="list-style-type: none"> Repetition mostly avoided Some minor digression Supporting argument relevant Quality of source extracts acknowledged 			2
Quality of argument supporting decision [x 2]	<ul style="list-style-type: none"> Writing consists of facts with little linkage or reasoning Reasoning incorrect 	<ul style="list-style-type: none"> Maximum if no clear decision in support Reasoning correct, but hard to follow Ordinary; some linkage evident 	<ul style="list-style-type: none"> Supports the position Reasoning is clear Minor errors in flow Linkage sometimes missed 	<ul style="list-style-type: none"> Strongly supports a clear position Reasoning is very clear and succinct Flow is logical Compelling with regular linkage Well-integrated argument 	8

<p>Fairness – counter opinions to decision</p>	<ul style="list-style-type: none"> • One to two counter opinions from the sources given 	<ul style="list-style-type: none"> • Three to four counter opinions from the sources given 	<ul style="list-style-type: none"> • Integration of one to two counter opinions from the sources into argument 	<ul style="list-style-type: none"> • Integration of three to four counter opinions from the sources into argument 	<p>4</p>
<p>Presentation</p>	<ul style="list-style-type: none"> • Writing is almost unintelligible • Tone, language, terminology unscientific and very weak • Introduction and/or conclusion not present 	<ul style="list-style-type: none"> • Tone, language, terminology weak • Introduction and conclusion present 	<ul style="list-style-type: none"> • Tone is consistent and suited to scientific language • Good and appropriate language and terminology • Mostly appropriate paragraphing • Introduction and conclusion have merit 	<ul style="list-style-type: none"> • Tone is mature and suited to scientific language • Excellent and appropriate language and terminology • Correct paragraphing with good transitions • Interesting introduction, satisfying conclusion 	<p>4</p>
<p>Scientific merit</p>	<p>Essay shows academic rigor, accurate reasoning, insight and cohesiveness</p>				<p>2</p>
<p>Total Possible Mark</p>	<p style="background-color: black; color: black;">[REDACTED]</p>				<p>40</p>