



INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
NOVEMBER 2022

BIOLOGY: PAPER I
MARKING GUIDELINES

Time: 3 hours

200 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 matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

QUESTION 1

1.1	COLUMN A	COLUMN B
	[E] A hormone that stimulates development of secondary sexual characteristics in males.	A Fallopian tube/oviduct
	[A] Part of the female reproductive system where fertilisation takes place.	B Placenta
	[G] Lining of the uterus shed during menstruation.	C FSH
	[B] An organ that provides nutrients and oxygen to the foetus.	D Cervix
	[I] A sharp increase in this hormone causes ovulation.	E Testosterone
	[H] Surrounds and protects the developing foetus.	F Vagina
	[L] A male accessory gland found at the base of the male bladder.	G Endometrium
	[K] Structure that allows the testes to be cooler than body temperature.	H Amniotic fluid
	[C] A hormone that stimulates the development of ova in the ovaries.	I LH
	[D] The structure that dilates during natural childbirth.	J Seminal vesicle
		K Scrotum
		L Prostate

1.2	Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6
	Answer	A	C	C	C	D	B

1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5
	A	A	B	C	B

1.4 1.4.1 First to make/use tools

1.4.2 *africanus*

1.4.3 C

1.4.4 (a) Skull set 2

(b)

Skull set 2	Skull set 1
Smaller cranium	Larger cranium
Protruding face/elongated face/protruding jaw/prognathic	Less protruding face/flatter face/smaller jaw/less prognathic
Elongated skull	Rounded skull
Protruding (larger) eyebrow ridges	Flattened (smaller) eyebrow ridges
Chin not well defined	Well defined chin
Bigger cheekbones	Smaller cheekbones
Sloping forehead	Vertical/upright forehead
U-shaped/parabolic jaw	V/C-shaped jaw
Visible cranial ridge	No cranial ridge

Accept any other feasible, observable comparison
Mark first TWO comparisons related to the skull/
differences between two features to be clearly articulated
 Candidate can say skull set 2 has ... in comparison to skull set 1

- (c)
- Arms are shorter than legs
 - Knee joints are larger and stronger
 - Foot has an arch
 - Big toe in line with other toes (non-opposable)
 - Short, wide pelvis
 - S-shaped spine
 - Femur angled inward
 - Smaller shoulders

Mark first TWO – NB: not skull

- (d)
- Upright bodies expose a smaller surface area to the sun which reduces risk of overheating while hunting, foraging for food or escaping from predators.
 - Upright bodies expose a larger surface area to air currents which causes cooling and reduces dependency on water.
 - Hands are free to use tools, prepare food, hunt or fight, to carry their babies
 - Vision extends further over tall grass to look for food or avoid predators
 - Exposing genitalia to display sexual maturity
 - Appear larger to be more intimidating
 - Using 2 limbs instead of 4 is more energy efficient

Mark first ONE only

- 1.4.5 (a) Homo sapiens/Modern humans originated in Africa and migrated to the rest of the world There were two migrations from Africa

First group of *Homo erectus* moved north, out of Africa to Europe but a group remained in Africa /first migration of *Homo erectus*.

Remaining *Homo erectus* evolved into *Homo sapiens* in Africa and then moved up to Europe in a second wave of migration dominating all Homo species that were in Europe

1 mark for the concept of Africa – originated in Africa/moved out of Africa

Any 4 facts

- (b) Climate change /looking for new resources/food /more adaptable and could survive in a range of climates /followed large herbivores northward /competition /lack of resources/to reduce competition/etc.

Mark first ONE only

- 1.4.6 **Yes**

- May still contain valuable fossils that can be used to further evolutionary research/learn about the past
- Future generations have something to go back to learn about their evolutionary history
- Part of our heritage

Accept any other well explained reason

No

- Waste of time and money since no longer in use

Accept any other well explained reason

Yes/No – no mark awarded

1 reason well explained or 2 reasons listed

If YES or NO is not indicated - assume decision by reading through and marking their reason

- 1.4.7 (a)
- Not considered a female profession
 - Seen as taboo if females study these fields
 - Females pushed aside by males who dominate these fields/workplace inequalities
 - Males employed over females, so females have stopped going into the field /any other valid reason.
 - Patriarchal societies
 - Societal pressures
 - Traditional pressures
 - Opposition towards female education

Accept any other valid reason

Mark first TWO

1 reason well explained or 2 reasons listed

- (b)
- Increase the number of women in science
 - Gain professional freedom
 - Equality in the science field
 - Reduce denigration of women in society
 - Get rid of gender inequality in education/workplace
 - Breaking the gender stereotype
 - More job opportunities

Accept any other feasible suggestion

- (c)
- Funding
 - Being able to complete schooling
 - Rising above traditional roles of women in society
 - Pushback from patriarchal societies/families
 - Religious backlash
 - Lack of awareness

Any ONE listed

Any other suitable answer

1.5 1.5.1 The frequency of endocrine disorders is high in central Ghana

OR The frequency of endocrine disorders is low in central Ghana

OR There is a need for well-trained endocrinologists to improve the health of the population

OR A higher percentage of patients suffer from hyperthyroidism compared to hypothyroidism

independent variable dependent variable statement

OR any other suitable hypothesis linked to the results found in the table

- 1.5.2
- Not enough endocrinologists/doctors in the country to treat current cases
 - Limited resources in the country mean that resources are used to treat more serious conditions
 - Less attention to endocrine disorders may not be a priority
 - Poor healthcare facilities

Any other suitable answer

1 reason well explained or 2 reasons listed

1.5.3 $9,2 / 100 * 410 = 37,72/38/37$ patients

1.5.4 Lack of iodine

QUESTION 2

2.1 B

- 2.2 2.2.1
- Drilling uses lots of water so water supply can run out/lack of water for people and animals
 - Drilling releases toxic chemicals into the water. Water becomes toxic to animals/people using the water supply

Mark FIRST well-explained reason or TWO stated reasons

- 2.2.2
- Habitat destruction
 - Loss of biodiversity
 - Decline in the elephant population
 - Loss of food resources for animals
 - Lack of resources for the San
 - (Rare) indigenous plants can become extinct
 - Soil erosion
 - Disrupts the migration routes of animals
 - Destabilises the ground/shifting of the plates
 - Noise pollution

***Any other suitable answer
Mark first THREE only***

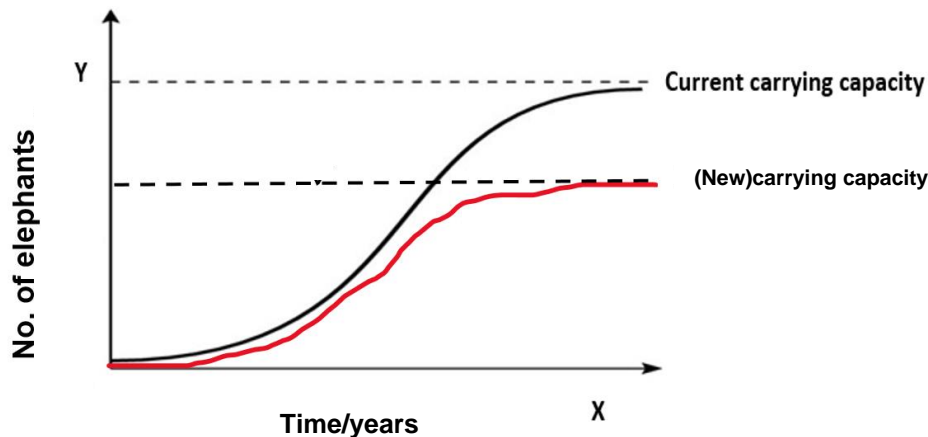
- 2.3 If elephants do not migrate:
- soil will not be fertilised
 - seeds will not be dispersed
 - no more water supplies for other animals
 - elephants will die as cannot reach food/water sources/extinction of elephants/reduction of elephant population
 - overgrazing
 - decrease in carrying capacity

Mark first THREE only

- 2.4 2.4.1 The maximum number (total amount) of elephants that can be supported/sustained by the resources

Maximum one mark if just providing definition of carrying capacity and not in context of elephants

2.4.2 **Graph showing the change in the carrying capacity of the elephant population in Namibia over the next twenty years if drilling continues**



2.5 Diameter: 4 mm (0,004 m)
Can accept 3 mm – 5 mm

Scale: 4 000 mm = 20 mm (1 mm represents 200 mm/0,2 m)
Can accept 18 mm – 22 mm

Method Mark: 4 mm × 200 mm = 800 mm = 0,8 metre (m)

OR 4 mm × 4 000 mm / 20 mm = 800 mm = 0,8 m(4)

2.6 2.6.1 **Yes**

- The indigenous people, historically, have rights to the land and by not consulting with them violates rights of these indigenous people
- The drilling affects their livelihood they require the information to make informed decisions, etc.

Any other well-explained reason

No

- The government has overall rights to the land does not need permission from the indigenous people

Any other well-explained reason

ONE valid, well-explained reason or 2 points listed

- 2.6.2
- Indigenous plants decline not enough for medicinal purposes/no treatment for certain conditions, possible death
 - Water will become toxic, fish will die/lack of food /cannot sell fish to make a living
 - Less tourists no income for the San
 - Not enough land for farming
 - Loss of wildlife impacts hunting

Accept other reasonable answers

Mark first THREE well-explained

The 2nd mark must link to the impact on the way of life for the San

- 2.7 2.7.1
- Hunt in packs, working together to coordinate the hunt
 - Hunt at dawn and dusk and use good sense of sight to find prey
 - Can run long distances without tiring prey tires so can be killed – can explain the relay method
 - Kill efficiently and quickly by one grasping tail and another grasping lip and others disembowelling the prey/bringing down larger prey
 - Swallow lots of food quickly, to prevent food being taken and then regurgitate back at the den

Mark FIRST TWO well-explained strategies

- 2.7.2
- Number of wild dogs will decrease in number so packs will be smaller not enough of dogs to co-ordinate the hunting
 - Disturb the ecosystem less prey/smaller hunting area
 - Contaminated water means lack of water for drinking
 - Noise pollution affects communication
 - Conflict between humans and wild dogs

Any other well-explained reason – not specifically linked to the hunting

- 2.8 2.8.1 Interspecific
- 2.8.2 Resource partitioning/co-existence
- 2.8.3 Density-dependent
- 2.8.4 Sunlight/CO₂/O₂/water /nutrients /soil

Mark first ONE only

QUESTION 3

- 3.1 3.1.1 A – vas deferens/sperm duct
C – penis/erectile tissue /erectile muscle
H – scrotum

- 3.1.2 Provides fluid with glucose /nutrients /fructose/vitamin C that gives sperm energy
Alkaline fluid – neutralises the acidity of the male urethra and the vagina in order to facilitate the survival of spermatozoa
Mucus makes the semen liquid/provides fluidity

Two functions listed or one function explained

- 3.1.3 Urine/Semen

- 3.1.4 (a) Period when individuals reach/develop sexual maturity/physical changes to the body as a result of hormones being released
- (b) G – Testes
- (c) Glyphosate blocks the FSH receptors in cells in testes interstitial (Leydig) cells not stimulated, testosterone not secreted, sperm production inhibited low sperm count (quantity/quality) can result in infertility.

Any 4 logical points

- (d) (i) Head
(ii) Contains (digestive enzymes) to digest/dissolve the membrane of the ovum at fertilisation
- (e) Mitochondrial activity is reduced/mitochondria is affected resulting in reduced cellular respiration so sperm cell does not have enough energy to swim efficiently will not reach ovum (in fallopian tubes)

Any TWO facts

- (f)
- Testes will not develop fully
 - Lack of facial/chest hair
 - Larynx does not develop/no deepening of the voice
 - Testis and penis will not enlarge
 - Muscle development will not be enhanced
 - Growth of skeleton/height

Mark first TWO only***Can just list the characteristics***

- 3.2 3.2.1 The (receptors) of the liver/body cells are not sensitive to insulin therefore glucose not absorbed, and glucose not converted to glycogen. Glucose levels remain high (not reduced) in the blood

Any 4 logical points

- 3.2.2 Exercise/change in diet/weight loss, etc.

3.3 3.3.1 **Two female reproductive hormones and their functions**

Number	Name of Hormone	Function of Hormone
3	Progesterone	<ul style="list-style-type: none"> • Development of the endometrium • Thickening of the endometrium • Maintains the endometrium during pregnancy
4	Oestrogen	<ul style="list-style-type: none"> • Controls development of secondary sexual characteristics in females • Inhibits secretion of FSH • Repairs/starts thickening of the endometrium

Format border/outside frame

Ignore the numbers, 3 and 4, when marking

When hormones are not named, then look at numbers indicating the hormones

- 3.3.2 The contraceptive pill contains two hormones, namely, **progesterone/oestrogen** and **oestrogen/progesterone**. When on the pill, the levels of these hormones do not fluctuate like in a normal cycle, the hormones remain **constant**. Oestrogen inhibits the secretion of **FSH**, by the **pituitary gland**, and this results in no maturation of an **ovum**. High level of progesterone inhibits the secretion of **LH** so **ovulation** does not occur on day 14. Oestrogen is secreted by the **Graafian follicle** within the ovary.

QUESTION 4

- 4.1 4.1.1 If a mother is pregnant with a tuskless male; the foetus is aborted before the tuskless male can be born
- 4.1.2 Poaching can describe the poaching, e.g., elephants were slaughtered
- 4.1.3 (a) Punctuated equilibrium the evolution of tuskless elephants happened very quickly /over a short period of time/15 years.
 (b) No – Not reproductively isolated/still live in the same area The tuskless females can still mate with tusked males and produce fertile offspring
- 4.1.4 Natural selection – humans were not intentionally selecting no tusks the environment the elephants lived in at that time favoured the tuskless elephants tuskless elephants continued to mate naturally and pass the trait on

OR Artificial selection – because humans continued to poach elephants with tusks, only elephants with no tusks were left to mate with each other The allele for the tusk became limited/reduced in the gene pool and was passed on less often

- 4.1.5
- There is variation in the population some have tusks and others do not.
 - Due to poaching of the tusked elephants, more tuskless female elephants (that lacked the gene for tusks) survived to reproduce.
 - The tuskless female offspring that survived, reproduced and passed on the tuskless gene to female offspring.
 - If males inherited the gene, they died.
 - Over many generations a higher frequency of tuskless female elephants were born creating a larger population of tuskless female elephants/resulting in the tuskless feature being more common/larger proportion

Any 6 logical points in context with tuskless elephant evolution

- 4.1.6
- Cannot dig for water
 - Cannot access food/strip bark
 - Cannot defend/protect themselves

Mark first THREE only

4.2 4.2.1 Cladogram/phylogenetic tree

4.2.2 Fossil evidence and DNA/genetic evidence

4.2.3 **Tree A** – shows that these elephants are closely related as they share a recent common ancestor/branched more recently

Tree B – These elephants are distantly related African elephant more closely related to straight tusked elephant as they both share a recent/closer common ancestor/closer common ancestor than with the African savannah elephant/The African forest elephant and the African savannah elephant are on different recent branches

- 4.2.4
- The two elephant populations were separated from each other by a barrier
 - can name the barrier e.g., forest and savannah OR can describe the barrier e.g., forest elephants lived in central and western Africa and savannah elephants lived in southern and eastern Africa/preference for different habitats/climates/reduction in forest area
 - Some of the elephants remained in the forests and others moved to the savannah these groups of elephants became reproductively isolated (no mating/no reproduction) and this prevented gene flow
 - Each group adapted to new environmental conditions /were selected for different characteristics
 - Random mutations/new variations occurred within the small population.
 - Over time, an accumulation of these changes resulted in a new species.

Any SIX logical steps

4.2.5 The savannah elephant and the forest elephant require different conservation strategies since they are facing different selection pressures. Instead of stating the selection pressures, candidates will describe the differences in the habitat

- 4.2.6
- **Improve methods of elephant protection and management** – provide equipment and training to anti-poaching agents / develop community-based wildlife management centres
 - **Reduce illegal trade** – stricter punishment
 - **Reduce elephant-human conflict** – more awareness/ education
 - **Habitats must be restored/protected** – create more protected areas/start rehabilitating areas that have been destroyed

Any other suitable answer

Name and explain one strategy

- 4.2.7 (a) A
- (b) C
- (c) B

Total: 200 marks