PROPOSED MARKING GUIDE TO A'LEVEL BIOLOGY

UNEB PAPER 2 - P530/2 - 2024

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NB Question Paper is attached checkdown!!

NO1

(a)(i) From figure 1, describe the changes in the Concentration of

(i) Abscisic acid (03 marks)

Solution

From 0 to 20 days, the Concentration decreased rapidly; ✓

From 20 to 40 days, the Concentration decreased gradually; ✓

From 40 to 50 days, the Concentration decreased slightly; Accept slowly

Max 03

(ii) gibberellic acid (05 marks)

From 0 to 25days, the Concentration increased gradually; ✓

From 25 to 40 days, the Concentration increased rapidly ✓ to a peak; ✓ Accept maximum

From 40 to 50 days, the Concentration decreased rapidly ✓ to zero; ✓

Accept sharply

Max 05

(b) From figure 1, explain the changes in the concentration of

(i) abscisic acid (05 marks)

Solution

Cold treatment (chilling) reduces the abscissic acid content of the seed coat; increasing it's permeability; to water uptake; which dilutes the abscissic acid concentration during germination;

MaX 05

(ii) gibberellic acid (05 marks)

Solution

Chilling (cold treatment) enables the embryo to make gibberellic acid after imbibition; which stimulate synthesis of enzymes that hydrolyses the stored food in endosperm; and later the gibberellic acid concentration decreases due to depletion of the stored food; and it's utilization to make enzymes.

MaX 05

(C) Explain how the concentration of

(i) abscisic acid in figure 1 relates to the percentage of seeds that germinated in figure 2 (05 marks)

Solution

As the concentration of abscissic acid decreases / reduces; the percentage of seeds that germinated increases; this is because decreased in the concentration of ABA increase permeability of seed coat enabling water uptake; activating the hydrolytic enzymes; breaking seed dormancy and promote germinating;

(ii) gibberellic acid in figure 1 relates to the percentage of seeds that germinated in figure 2

Solution.

From 0 to 40 days; as the Concentration of gibberellic acid increases; the percentage of seeds that germinated also increases. this because after imbibing water, the embryo secretes gibberellic acid which diffuses to the aleurone layer, stimulating synthesis of several enzymes forexample α-amylase, that Catalyse the breakdown of food reserve in the endosperm; and the products of breakdown (digestion) diffuse to the embryo; where they are used in growth.

Accept riles

~~From~~ Max 05

(d) Explain the significance of Cold treatment of seeds before planting. (03 marks)

Solution

- Cold treatment reduces the abscissic ~~acid~~ Content of the seed coat; which makes it permeable to water ~~for~~ for germination.
- Cold treatment enables the embryo to make ~~gibberellic~~ gibberellic acid that stimulate synthesis of hydrolytic enzymes that breaks down the stored food; forming products for ~~growth~~

Any 03

1(e) Explain why a seed may remain dormant after dispersal even when the environmental conditions are favourable for germinato (04mks)

Solution:

- Hard and impermeable testa, preventing water and embryo from entering the seed, hence preventing physiological processes of germination.
- Immature embryo may fail to grow
- Germination may be prevented by inhibitors eg Abscissic acid
- Germination may be inhibited by light
- Temperature may be unfavourable
- Harsh environmental conditions

Any Correct 04

Max 04

1(f) State the ecological significance of dormancy in seeds soon after dispersal (02 mks)

Solution.

Enables the plant survive adverse conditions, only germinate under favourable environmental conditions.

max 02

1(g) State three applications of plant growth hormones (03 mks)

Solution.

- Promotes plant growth eg auxin, gibberellic acid.
- Induces dormancy eg Abscissic acid
- Promote abscission eg Abscissic acid

- Promotes apical dominancy eg auxin ✓
- Initiates germination eg Giberellic aid ✓
- Initiates germination eg Gibberellic aid ✓
- Promotes fruit ripening eg ethene ✓
- Delay leaf senescence eg cytokinin ✓

max 03

Any 03

SECTION B [5 questions]

2(a) How is the structure of a mitochondrion suited for its function (12 marks)

Solution

- The double membranes; separate the mitochondrion from interference by processes in the cytoplasm.

- Narrow inter membrane space; enables proton concentration gradient to be rapidly established hence chemiosmosis can occur.

- Small size; gives a large surface area to volume ratio for rapid uptake and release of materials.

- Matrix; Contain enzymes that catalyse reactions of krebs cycle

- Inner membrane invaginates to form Cristae; to increase the surface area for electron transport system.

- Inner membrane has cristae; with oxysomes that contain ATp synthetase (ATpase) and stalked particles that make ATp.

- Inner membrane contain molecules; for electron transport pathway.

- DNA is present; to act as genetic material for the synthesis of some protein

- Presence of many ribosomes; for protein synthesis to reduce on importation of some proteins.

Any Correct 6 points Max 12

(b) How is ATP produced from NAD in the mitochondrion? (08 marks)

Solution

- Reduced NAD move to the inner membrane of the mitochondrion.
- Hydrogen passes from reduced NAD to FAD.
- Hydrogen then splits into hydrogen ions (H^+) and electrons.
- Electrons are passed from one Carrier to the next, moving downhill in energy terms, until they reach oxygen, which is reduced to water as a result
- At each transfer some energy is released and in some of the transfers this is coupled to the formation of ATP.

Max 08

NO3

(a) Describe the life cycle of the Common Moss (16 marks)

Solution

A moss eg Funaria consists of two distinct forms in it's life cycle, the haploid gametophyte which is the dominant and sexual stage; and the diploid sporophyte which is the asexual and less conspicuous stage.

A gametophyte may bear both sex organs the antheridia and archegonia or they may be borne on separate gametophyte plants.

On maturing, the antheridia shed sperms; antherozoids that are aided by rain-splash to reach the open neck of archegonia; and they are attracted by chemicals eg Sucrose enables them to reach the archegonia. The haploid antherozoids fuse with the haploid eggs to form diploid zygotes.

The zygotes develop into diploid sporophytes which remain attached

and surviving on the gametophytes

At maturity the sporophyte produces haploid spores by meiosis within a spore capsule, which splits open when dry and the spores are dispersed by wind -

On landing on moist soils; each spore germinates into a green filamentous protonema which produces buds that grow into new haploid gametophyte.

MAX 16

b) State any four problems faced by terrestrial plants [04] marks

- Desiccation hence dry out
- support in air / on land
- obtaining nutrients
- obtaining gases for respiration
- Movement of the reproductive gametes
- Environmental variables such as light intensity, temperature, pH etc

Any 04

NO 4 (a) How is the structure of the retina of a mammalian eye suited for it's function (11 marks)

Solution;

The retina consist of three layers of cells namely;

- photoreceptor layer
- Intermediate layer
- Internal surface layer;

✓ photoreceptor layer; this out most layer, contains photosensitive cells called rods and cones, which are partially embedded in the microvilli of the pigmented epithelium of the choroid, for vision

✓ The rods are numerous cells within the retina; they are elongated cells and uniformly distributed throughout the retina except at the fovea; enabling night vision.

✓ The rods are much more sensitive to light than the cones; and therefore respond to lower light intesh intensities, hence suitable for night vision.

✓ Rods contain vesicle which contain a photosensitive pigment called rhodopsin, these cells undergo synaptic convergence to increase their sensitivity.

✓ The cones are elongated cells, greatly concentrated at fovea; responding to high light intensity and are used principally in day light

✓ Cones has numerous infoldings of the outer region containing alot of iodopsin; the photosensitive pigment for vision

- Intermediate layer Contain bipolar neuron with Synapses Connecting the photoreceptor layer to the third layer.

- Horizontal and amacrine Cells in the intermediate layer enable lateral vision to occur.

- Inter surface layer, Contain ganglion Cells with dendrites in Contact with bipolar neurons and axons of the optic nerves

Any Correct 11

MAX 11

b) Outline the differences between the structure and function of the Mammalian rods and Cones. (09 mks).

Rods	Cones
Have retinal Convergence	Lack retinal Convergence ✓
outer segment is rod shaped	outer segment is cone shaped ✓
Poor Colour vision	Have high ability of recognizing Colours ✓
photochemical pigment is readily regenerated when bleached	Pigment take long to be regenerated once bleached ✓
Sensitive to low light intensity	Not sensitive to low light intensity ✓
Distributed more at the periphery of the retina	Concentrated in the fovea ✓
Contain rhodopsin as the photosensitive pigment	Contain iodopsin as the photosensitive pigment ✓
lower threshold value	Higher ~~ther~~ threshold value ✓
one type More in number on the retina	Three sub types ✓ Fewer on the retina

No 5(a) Compare gaseous exchange and ventilation mechanism in bony Fish and Cartilaginous fish (12 marks)

Similarities:

- Both use gill filaments as a respiratory surface ✓
- In both the respiratory medium is water. ✓
- In both gaseous exchange occur by diffusion ✓
- In both ventilation is achieved by Contraction and relaxion of buccal and opercular muscles ✓
- In both flow of water/air is unidirectional ✓
- In both water enters via the mouth ✓
- In both gases (respiratory gases) are transported in branchial blood vessels ✓
- In both respiratory pigment is haemoglobin ✓
- In both; water flow from a region of high into Any 06
  a region of lower pressure. ✓ Max 06

Differences.

Differences.

Any 06

Bony fish	Cartilaginous fish
- Counter Current exchange mechanism	Parallel flow exchange mechanism. ✓
- Maintains a Concentration gradient across gill plate	- Concentration gradient not ~~not~~ maintained across gill plate ✓
-Achieves a high exchange efficiency of up to 80%	Lower exchange efficiency of about 50% ✓
- Water enter via mouth only	Water enter via mouth and spiracle ✓
- The gas exchange surface enclosed with operculum	Gas exchange surface is open to the atmosphere via gill slits. ✓
- Ventilation due to adjustments in buccal, opercular and pharynx	ventilation due to adjustments in buccal cavity and pharynx ~~only~~. only ✓
- All gills are ventilated	Not all gill are ventilated ✓
Slower speed of water flow over gill lamellae	Faster speed of water flow over gill lamellae ✓
- four pairs of gills are involved	Five pairs of gills are involved. ✓
- Operculum valve open and close during ventilation	Branchial valves open and close during ventilation ✓

b) Describe the Control of breathing in Mammals (08 marks)

Solution.

Breathing is Controlled by breathing Centre in the Medulla oblongata of the hind brain; which Compose of expiratory and Inspiratory Centre;

Breathing is initiated by rise in Carbon dioxide level // low pH in blood; which is detected by chemoreceptors located in Carotid artery ie Carotid bodies and aortic arch ie aortic bodies, which became stimulated, and fires impulses to Inspiratory Centre via afferent nerve;

- The inspiratory Centre interpretes and sends impulses to the intercostal muscles via intercostal nerves and to the diaphragm via phrenic nerve; resulting into inspiration; lungs expands.

- Stretch receptors in branchial tree become stimulates; sends impulses to expiratory Centre via vagus nerve; which automatically switches off the inspiratory Centre, and sends messages to intercostal and diaphragm muscles to relax; causing expansion.

MeX 08

6(a) Describe the Structure of a chloroplast (07 marks)

Solution

- Each chloroplast is bounded by two membranes forming a chloroplast envelope.

- The outer membrane is smooth, while the inner membrane is folded to give rise to a series of branching layers called lamellae.

- The inner membrane is highly selective to entry and exit of materials into and out of the chloroplast

- Has membrane system that consist of many, closed, flattened sacs called thylakoids which contains chlorophyll

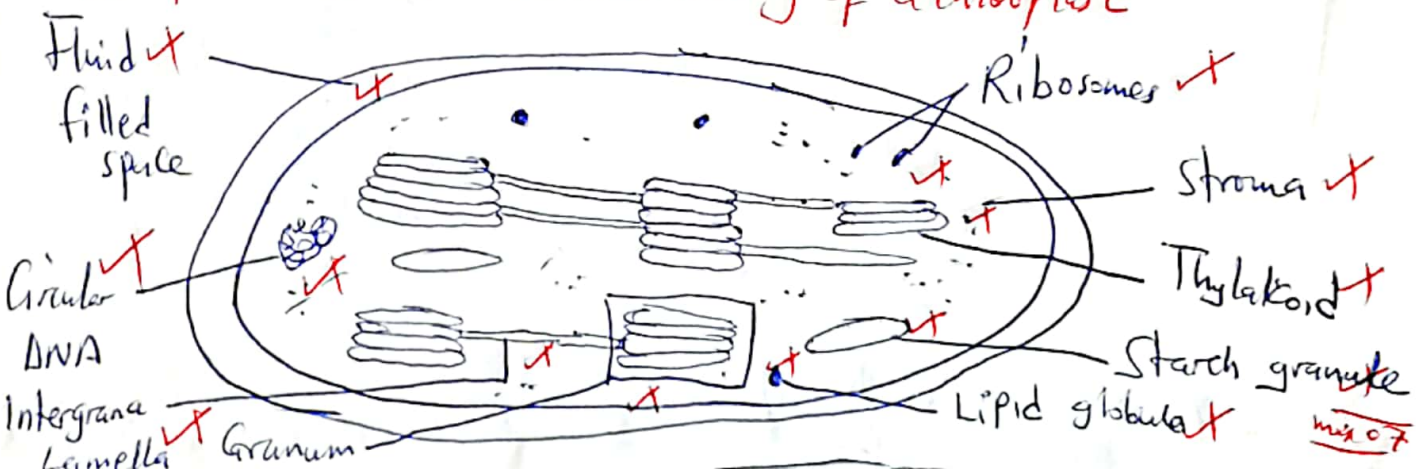
- The thylakoids are stacked at intervals to form grana with inter-grana lamellae between the grana

- The thylakoids are embedded in a watery colorless gelatinous matrix forming a ground substance called the stroma

- The stroma contains the enzymes, starch granules, and other chemicals such as sugars and acids.

MAX 07

Accept a drawing A well labelled drawing of a chloroplast



MAX 07

(b) Outline the process of Sucrose synthesis in C4 plants.

Solution. 07 marks.

Carbon dioxide diffuses into the mesophyll cells of C4 plants; and combines with phosphoenol pyruvate to form oxaloacetic acid under Catalysis of phosphoenol pyruvate Carboxylase enzyme (PEP Carboxylase)

- Oxaloacetic acid is reduced by $NADPH_2$ to form malate (malic acid)
- Malate is shunted into chloroplasts of the bundle sheath cells via plasmodesmata in the cell walls.
- Malate is Converted to pyruvate; by having Carbon dioxide and hydrogen removed
- Carbon dioxide enters Calvin cycle; where it combines with Ribulosebisphosphate (RUBP) to form 2 glycerate-3-phosphate (GP); Under Catalysis of RUBP Carboxylase;

GP is reduced by $NADPH_2$ and phosphorylated by ATP to form 12 molecules of Triose phosphate (TP).

About Two out of 12 molecules of triose phosphate; are then used to make glucose which is Converted into Sucrose

Max 07

(C) Explain how temperature and altitude influence the distribution of C_3 and C_4 plants (06 marks)

Solution

C_4 plants.

The Carbon dioxide fixing enzymes in C_4 plants are more active at hot temperature and high illumination conditions therefore photosynthesis occurs rapidly at low altitude, hot and brightly lit tropical conditions.

Max 03

C_3 plants.

The Carbon dioxide fixing enzymes in C_3 plants are more active at cool, moist and low illumination conditions therefore photosynthesis occurs rapidly at high altitude with cool temperature and in low light intensity of temperate conditions

Max 03

Total 06

'plain 1

P530/2
BIOLOGY
Paper 2
(Theory)
Nov./Dec.2024
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

BIOLOGY

Paper 2
(Theory)

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **two** *Sections;* **A** *and* **B**. *It has* **six** *questions.*

Section **A** *is* **compulsory.**

Answer any **three** *questions from Section* **B.**

Answer **four** *questions in all.*

Any additional question(s) answered will **not** *be marked.*

Begin answering each question on a fresh page.

You are advised to read the questions carefully, organise your answers and present them precisely and logically, illustrating with well labelled diagrams where necessary.

Turn Over

dispersal even when the
nation. (04 marks)

on after

SECTION A (40 MARKS)

1. Figure 1 shows the changes in the concentration of two growth hormones, abscisic acid and gibberellic acid in germinating apple seeds maintained at 25 °C after a period of cold treatment.
Figure 2 shows the percentage of apple seeds that germinated under the same conditions.

Study the two figures and answer the questions that follow.

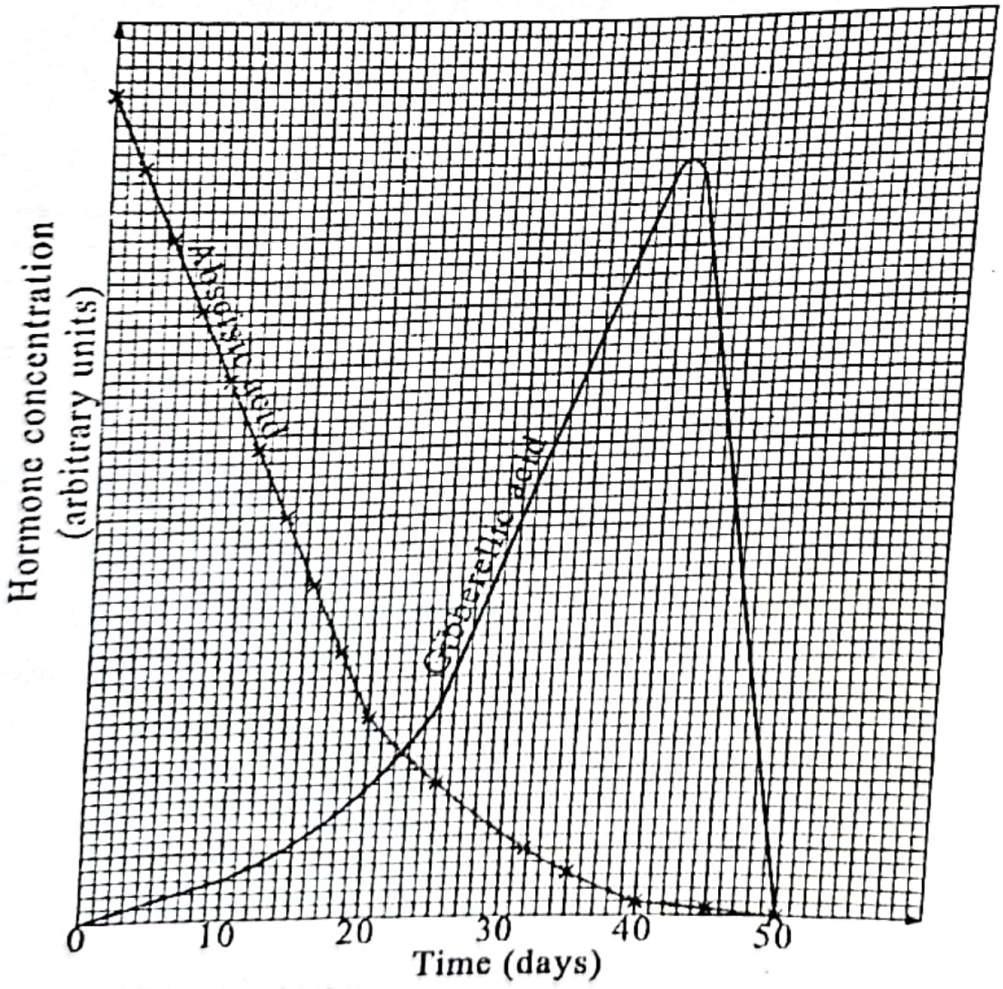


Fig. 1

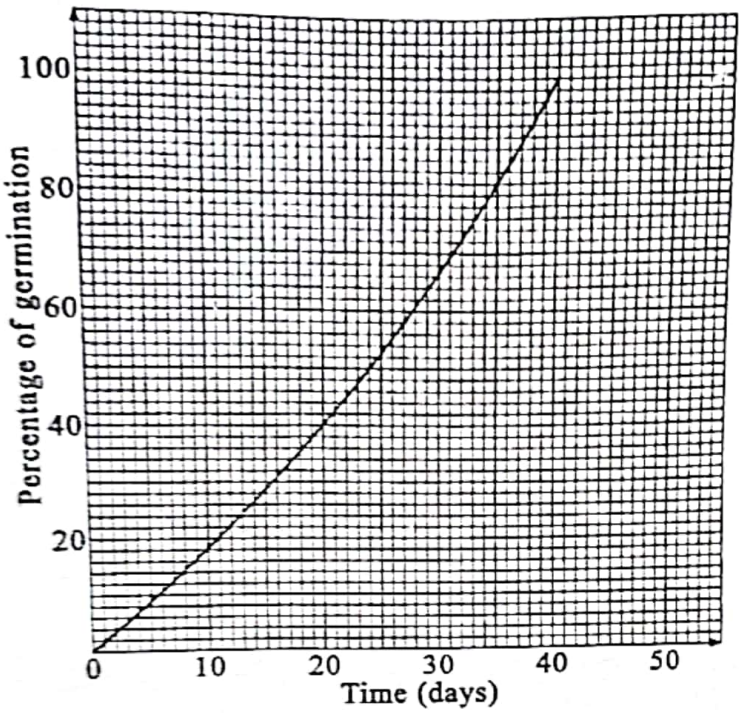


Fig. 2

(a) From figure 1, describe the changes in the concentration of;
(i) abscisic acid. *(03 marks)*
(ii) gibberellic acid. *(05 marks)*

(b) From figure 1, explain the changes in the concentration of;
(i) abscisic acid. *(05 marks)*
(ii) gibberellic acid. *(05 marks)*

(c) Explain how the concentration of;
(i) abscisic acid in figure 1 relates to the percentage of seeds that germinated in figure 2. *(05 marks)*
(ii) gibberellic acid in figure 1 relates to the percentage of seeds that germinated in figure 2. *(05 marks)*

(d) Explain the significance of cold treatment of seeds before planting. *(03 marks)*

(e) Explain why a seed may remain dormant after dispersal even when the environmental conditions are favourable for germination. *(04 marks)*

(f) State the ecological significance of dormancy in seeds soon after dispersal. *(02 marks)*

(g) State **three** applications of plant growth hormones. *(03 marks)*

SECTION B (60 MARKS)

Answer any **three** *questions from this section.*
Any additional question(s) answered will **not** *be marked.*

2. (a) How is the structure of a mitochondrion suited for its function? *(12 marks)*

(b) How is ATP produced from NAD in the mitochondrion? *(08 marks)*

3. (a) Describe the life cycle of the common moss. *(16 marks)*

(b) State any **four** problems faced by terrestrial plants. *(04 marks)*

4. (a) How is the structure of the retina of a mammalian eye suited for its function? *(11 marks)*

(b) Outline the differences between the structure and function of the mammalian rods and cones. *(09 marks)*

5. (a) Compare gaseous exchange and ventilation mechanism in bony fish and cartilaginous fish. *(12 marks)*

(b) Describe the control of breathing in mammals. *(08 marks)*

6. (a) Describe the structure of a chloroplast. *(07 marks)*

(b) Outline the process of sucrose synthesis in C_4 plants. *(07 marks)*

(c) Explain how temperature and altitude influence the distribution of C_3 and C_4 plants. *(06 marks)*