

**UNIVERSITY OF SWAZILAND****MAIN EXAMINATION PAPER**

PROGRAMME: BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION, YR 2
BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION, YR 3
BACHELOR OF SCIENCE IN AGRICULTURAL EXTENSION, YR 2
BACHELOR OF SCIENCE IN AGRONOMY, YR 2
BACHELOR OF SCIENCE IN AGRONOMY, YR 3
BACHELOR OF SCIENCE IN HORTICULTURE, YR 2
BACHELOR OF SCIENCE IN HORTICULTURE, YR 3

COURSE CODE: CP305/CPR203

TITLE OF PAPER: CROP PHYSIOLOGY

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS
MARKS ARE SHOWN AGAINST EACH QUESTION

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QUESTION 1

Circle the correct answer for the following statements [15 marks]

1. According to the acid growth hypothesis, auxin works by

- A. dissolving sieve plates, permitting more rapid transport of nutrients.
- B. dissolving the cell membranes temporarily, permitting cells that were on the verge of dividing to divide more rapidly.
- C. changing the pH within the cell, which would permit the electron transport chain to operate more efficiently.
- D. allowing the affected cell walls to stretch.
- E. greatly increasing the rate of deposition of cell wall material.

2. In the C₄ pathway, what happens to the CO₂ formed when malate is decarboxylated in bundle-sheath cells?

- A. It is released in the process of photorespiration.
- B. It is released in the process of dark respiration.
- C. It enters the Calvin cycle.
- D. It reacts with serine to form phosphoglycolate.
- E. It enters the vacuole.

3. Which of the following statements about Pr and Pfr is FALSE?

- A. They are photoreceptors.
- B. They participate in photoconversion reactions.
- C. Pr is the biologically active form.
- D. Pr absorbs 660-nanometer light.
- E. Pfr absorbs 730-nanometer light

4. Which of the following statements about circadian rhythms is FALSE?

- A. They are endogenous.
- B. They can be entrained by light-dark cycles.
- C. They can be entrained by temperature cycles.
- D. They speed up as the temperature rises.
- E. They enable the plant to measure changing daylength

5. Which of the following statements about stomates is FALSE?

- A. Stomatal opening and closing is the function of the guard cells
- B. When the stomates are open, the internal concentration of K^+ is low
- C. Stomatal opening is triggered by light
- D. Stomatal opening is also tied to a 24 hour cycle (a circadian rhythm)
- E. All of the above statements about stomates are TRUE

6. According to the pressure-flow hypothesis of phloem transport,

- A. solute moves from a high concentration in the "source" to a lower concentration in the "sink."
- B. water is actively transported into the "source" region of the phloem to create the turgor pressure needed.
- C. the combination of a high turgor pressure in the "source" and transpiration water loss from the "sink" moves solutes through phloem conduits.
- D. the formation of starch from sugar in the "sink" increases the osmotic concentration.
- E. the pressure in the phloem of a root is normally greater than the pressure in the phloem of a leaf.

7. Which of the following elements is incorrectly paired with its function in a plant?

- A. nitrogen: component of nucleic acids, proteins, coenzymes
- B. magnesium: component of chlorophyll; activates many enzymes
- C. phosphorus: component of nucleic acids, phospholipids, ATP, several coenzymes
- D. potassium: osmosis; operation of stomata
- E. sulphur: component of DNA; deficiency is known to result in chromosomal abnormality.

8. If the guard cells and surrounding epidermal cells in a plant are deficient in potassium ions, all of the following would occur except

- A. photosynthesis would decrease.
- B. roots would take up less water.
- C. phloem transport rates would decrease.
- D. leaf temperatures would decrease.
- E. stomata would be closed.

9. The minerals involved in water-splitting reaction during photosynthesis are

- A. Magnesium Chlorine
- B. Potassium and Manganese
- C. Manganese and Chlorine
- D. Molybdenum Manganese

10. Assertion: Deficiency of sulphur causes chlorosis in plants. Reason: Sulphur is a constituent of chlorophyll, proteins and nucleic acids.

- A Both the Assertion and the Reason are true and the Reason is a correct explanation of the Assertion.
- B Both the Assertion and the Reason are true but the Reason is not a correct explanation of Assertion.
- C Assertion is true but the Reason is false.
- D Both the Assertion and the Reason are false.

QUESTION 2

State a phrase or term (s) that correctly completes the statements below [15 marks]

- a) Cell elongation in internodal regions of the green plants takes place due to the following hormone action _____
- b) Ratio between the total leaf area (or photosynthesizing tissue) to the total respiring plant tissues (or total plant biomass) _____
- c) Light response that lead to lateral growth giving shoots and roots of plants recognizable architecture _____
- d) Coiling of garden pea tendrils around any support is an example of _____
- e) When leaf water potentials drop due to water deficits, turgor is insufficient to drive this process _____
- f) The response of different organisms to the environmental rhythms of light and darkness is called _____
- g) The phytohormone, _____, which increases the concentration of potassium in guard cells is also responsible for the induction of _____
- h) Application of water soluble solid fertilizer or liquid fertilizer through an irrigation system _____
- i) Catalyze movement of one type of ion or molecule against its concentration gradient coupled with the movement of a different ion or molecule in the opposite direction _____

QUESTION 3

Match the term in Column 1 with statement that best describe it in Column 2. As an example, in your answer book, simply write 11 = G. [15 marks]

Column 1		Column 2	
1.	Cytokinin	A	Photothermal responses of plants
2.	Phloem loading	B	Stimulates production of pectinases and cellulase which helps create many intercellular spaces characteristic of hydrophytes
3.	Cell enlargement	C	Remobilization from the mature leaves and delivery of this element to the sink leaves is via phloem transport
4.	Calcium	D	Induces both cellular division and cellular elongation
5.	Heat units	E	Deficiency symptoms appear on older tissues because of translocation
6.	Phloem transport	F	Hormone action is sometimes mediated by this substance
7.	Ethylene	G	When leaf water potentials drop due to water deficits, turgor is insufficient to drive this process
8.	Chlorine	H	Deficiency causes premature leaf senescence usually from the stem base upwards
9.	Gibberellins	I	Uphill transport of sucrose from the apoplast into the sieve cells
10.	Calmodulin	J	Driven by metabolic processes of source and sink tissues

QUESTION 4

Indicate whether the statements below are true (T) or false (F). In your answer book, just write T or F. [15 marks]

- When shoots are exposed to light, a chemical substance migrates toward the light causing bending.
- Responses to cytokinin include adventitious root formation, delay of senescence, and stimulation of germination
- Long-day plants are governed by whether the critical night length sets a maximum number of hours of darkness
- Phloem unloading also depends upon the activity of phytohormones
- Base saturation is a measure of negative surface charge of soils and hence its ability to hold and exchange nutrient cations.
- The hormone produced during adverse environmental conditions is ethylene
- The Krebs or Citric Acid Cycle, takes place in the peroxisome
- Sink strength is a function of source strength
- In plants, over 3 weeks of age, with a well-developed enzyme system, ammonium uptake is preferred to nitrate nitrogen
- Cyclic photophosphorylation involves Photosystem II

QUESTION 5

Answer the following [40 marks]

- a) Turgor movements and growth movements are examples of major types of plant movements.
 - i. Briefly describe the two types of movements (4 marks)
 - ii. Give one example of the mechanisms or factor responsible for each of the two movements. (4 marks)
- b) "C3 plants are better than C4 plants". Explain, giving reasons, whether this statement is acceptable. (10 marks)
- c)
 - i. Describe briefly the stages of the process of respiration (6 marks)
 - ii. Explain the importance of each stage identified in (i) above. (6 marks)
- d)
 - i. Explain, what the following indices are used for. In your answer, give the appropriate formula and units for each index.
 1. Water potential
 2. Growing degree days
 3. Net assimilatory rate
 4. Phenology

(10 marks)