Biology Free Response Question (FRQ) Exam: Plant Biology

Instructions:

- *Answer all five questions in clear, concise, and complete sentences.*
- *Where appropriate, include labeled diagrams to support your response.*
- *For the data interpretation question, construct and label a graph based on the provided data.*
- *Be sure to explain biological concepts using proper terminology and provide examples when applicable.*

Question 1: Plant Classification & Adaptations

Plants have evolved different structures and reproductive strategies to adapt to various environments.

- **Compare** and **contrast** nonvascular plants, seedless vascular plants, and seeded vascular plants in terms of vascular tissue, reproduction, and water dependency.
- **Explain** how seed production in angiosperms and gymnosperms is an adaptive advantage over spore reproduction.

Question 2: Plant Tissues & Functions

Plants are composed of dermal, vascular, and ground tissues that work together to support growth and survival.

- **Identify** and **describe** the three main plant tissue types and explain their primary functions.
- A scientist observes that a certain mutation prevents the formation of xylem tissue in a plant. **Predict** and **explain** how this mutation would affect the plant's ability to survive and grow.
- Some plants, like cacti, have modified dermal and ground tissues. **Describe** two modifications and explain how they help plants survive in arid environments.

Question 3: Tropisms and Plant Responses to Stimuli

Plants respond to environmental stimuli through directional growth responses called tropisms.

- **Define** and **differentiate** between phototropism, gravitropism (geotropism), and thigmotropism.
- **Explain** the role of auxins in phototropism, describing how they affect cell elongation on different sides of a growing stem.
- Many climbing plants, such as vines, exhibit thigmotropism. **Explain** how this response provides an advantage in competition for sunlight.

Question 4: Flower Structure and Reproduction

Flowers are the reproductive structures of angiosperms and contain specialized organs that facilitate pollination and fertilization.

- **Identify** the male and female reproductive structures of a flower and describe their functions.
- **Explain** the process of pollination and fertilization in angiosperms, including the role of pollen, the stigma, and double fertilization.

Question 5: Hormonal Regulation & Data Analysis

Gibberellins (GA) are plant hormones that promote stem elongation by stimulating both cell division and elongation. However, their effects may be influenced by the presence of other plant hormones, such as auxins and cytokinins. A researcher investigates how different concentrations of gibberellins affect plant growth and whether the presence of auxins enhances or inhibits this effect.

The experiment involves four groups of identical plants:

- **Control** (No Hormone Treatment)
- **Low** Gibberellin Treatment (5 ppm GA applied daily)
- **High** Gibberellin Treatment (20 ppm GA applied daily)
- **High** Gibberellin + Auxin Treatment (20 ppm GA + 10 ppm Auxin applied daily)

The following data were collected over 10 days:

Days	Control (No Hormone) (cm)	Low Gibberellin (cm)	High Gibberellin (cm)	High Gibberellin + Auxin (cm)
0	5	5	5	5
2	6	7	9	10
4	7	9	14	18
6	8	11	19	26
8	9	13	24	34
10	10	15	28	42

- Graph the data from the table, plotting days on the x-axis and plant height on the y-axis. Include four lines representing each treatment group.
- Describe the trend in plant height for each treatment group. Compare the effects of low gibberellin vs. high gibberellin and analyze how the addition of auxin influences plant growth.
- A farmer wants to apply hormones to increase crop height and yield. Based on your findings, would you recommend using gibberellins alone or in combination with auxins? Justify your answer using scientific reasoning.

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